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A Study of the Application of *BUS TRANSYT* in Edmonton

by



Hay Micky Szeto

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

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IN

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THE UNIVERSITY OF ALBERTA
FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled A Study of the Application of *BUS TRANSYT* in Edmonton submitted by Hay Micky Szeto in partial fulfilment of the requirements for the degree of Master of Science in Civil Engineering.

ABSTRACT

In recent years, traffic conditions in urban areas have been experiencing a gradual deterioration. In order to provide an adequate level of speed, comfort, and reliability to public transportation, some transit priority schemes have to be taken into consideration. There are different types of bus priority schemes, and this study is devoted to the area of traffic signal priority for transit.

In the literature review presented in Chapter II, the different signal priority schemes for transit are examined. Basically, there are two types – active and passive. The active approach is divided into two subsets:

- 1) Unconditional preemption, and
- 2) Conditional preemption.

In the passive approach, there are:

- 1) Signal phase for buses only,
- 2) Adjustment of cycle length,
- 3) Splitting of phases,
- 4) Timing plans, and
- 5) Metering of vehicles.

In the early stages of this study, the aim was to investigate the performance of different transit signal priority schemes through a computer simulation model, *BUSPAS*, and to recommend the best signal strategy for transit operation in Edmonton.

A transit travel time survey was carried out in Edmonton on 107 Avenue from 101 Street to 124 Street, which featured a set of traffic actuated signalized intersections which were not interconnected. The purpose of this survey was to analyse the percentage constituent of each transit travel time component and to provide the necessary information for the simulation of the

proposed corridor with the *BUSPAS* program later on. The main findings were:

- 1) In the study section, total stopped-time delay accounted for an average of about 39 percent of the transit travel time.
- 2) The delay at signals was a major component, constituting about 17 percent of the transit travel time or an average of about 44 percent of the stopped-time delay.
- 3) There was no difference between the running speeds of the diesel and trolley buses at a 95 percent confidence level.

Due to some difficulties with the compatibility of computer operating systems, the computer program, *BUSPAS*, could not be executed. As a result the initial plan of testing various transit priority schemes through simulation could not be carried out in this study. At this writing, the *BUSPAS* program is operational and available.

The study area was altered to an investigation of the transit priority in areawide timing plan. The new objectives were to compare the performance of the timing plans optimized by *TRANSYT* for cases with and without transit priority, and to find out how much can be gained by giving passive priority to transit in Edmonton.

A real-life "*before-and-after*" study was carried out on Jasper Avenue from 111 Street to 117 Street. The "*before*" signal timing was derived from *TRANSYT*, in which bus volume was combined with the auto traffic. A bus was counted as the equivalent of three passenger car units. The "*after*" signal timing was also derived from *TRANSYT*, except that buses were simulated separately and priority was given to them.

The main conclusion was that buses did not gain a significant improvement in the overall travel time at 95 percent confidence level. The reasons were, first of all, the low bus-to-auto ratio in the study section, 1:26,

which caused the *TRANSYT* program to give a set of signal settings favouring the auto progression rather than that of the buses. Secondly, the previous fixed-time signal setting was a satisfactory one, thus establishing a good basis for comparison. Another cause could be the inadequate transit delay weighting assigned in the *TRANSYT* input data. A transit delay weighting of 20 was used in the *TRANSYT* simulation.

For the simulation of buses in the *TRANSYT* program, it appears that when the express bus-to-auto ratio is equal to or less than 1:93, it is not worth while spending extra time simulating two separate bus links for the regular stopping and non-stopping buses. One bus link with the stopping consideration will provide sufficient attention. Furthermore, any value from 5 to 30 assigned to the transit weighting will give the same signal settings if the bus-to-auto ratio is equal to or less than 1:26.

For the performance of the *TRANSYT* program in the prediction of the cyclic flow profile, another survey was conducted in the same study section. It appears that a K value of 50, employed to modify the smoothing factor F used in the platoon dispersion formula, was an appropriate number for the morning peak traffic. For the afternoon peak traffic, there was disagreement between the measured and the predicted traffic flow patterns. It appears that the difference was caused by, firstly, the wrong assumption made in plotting the profile and, secondly, the inappropriate empirical parameters used in the platoon dispersion formula.

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I. INTRODUCTION

In recent years, traffic conditions in urban areas have been experiencing a gradual deterioration. In most cases this has been caused by a stagnating supply and an increased demand. The increasing growth in population and car ownership, as shown in Figures 1.1 and 1.2, causes a continual demand for extending existing road facilities. The problems on the supply side involve the lack of capital, increased costs of facilities, land availability, and the lengthy time needed for implementation. Traffic congestion has become a recurrent phenomenon during peak hours. Public transit has particularly suffered from increased traffic congestion. It has been more and more difficult to provide its users with the level of speed, comfort, and reliability which they expect. Nevertheless, public transit should be encouraged over private transportation in many urban situations because it can:

- 1) reduce the demand on roadway facilities,
- 2) ease peak hour congestion,
- 3) relieve parking problems,
- 4) increase employment and social opportunities for people unable to drive automobiles,
- 5) improve the urban environment,
- 6) help in energy conservation.

In Edmonton, transit patronage declined from 1945 to the early 1960s. This is illustrated in Figure 1.3. After a restructuring of the transit system at that time, in which the radial route and timed transfers were introduced, the patronage has been steadily increasing. Transit usage was 110 rides per capita in the year 1975. However, this increase in patronage has not prevented the transit system from operating at a deficit. First of all, transit is labour intensive and operating costs depend significantly on increasing wages. Secondly, the productivity of the transit system has been decreasing steadily in the past few years, as shown in Figure 1.4. The main reason for this decrease is the increase

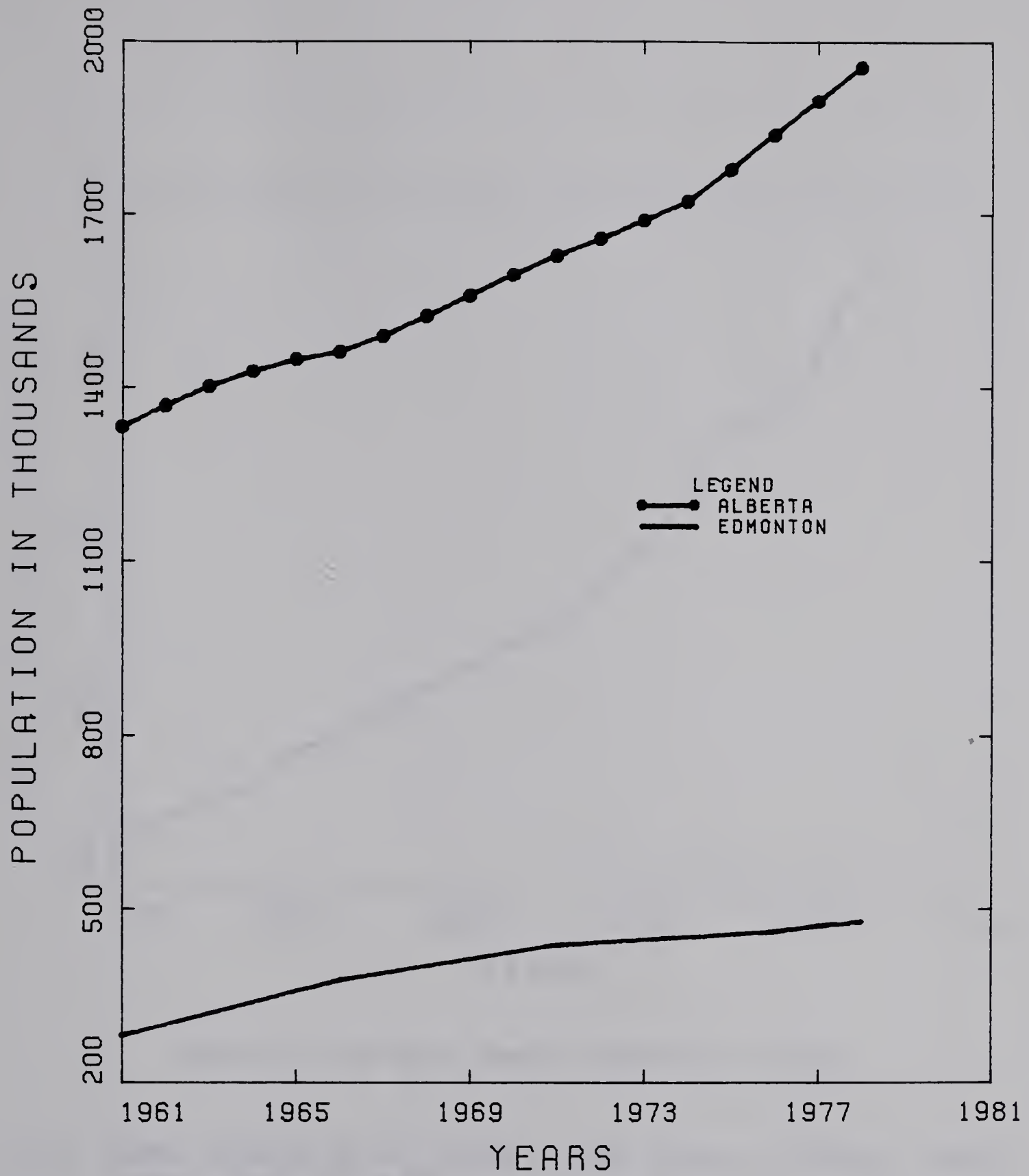


Figure 1.1 Population in Alberta and Edmonton

Source: Alberta Statistical Review, Annual - 1978. Bureau of Statistics, Alberta Treasury, Tables 1 and 2, p.4.

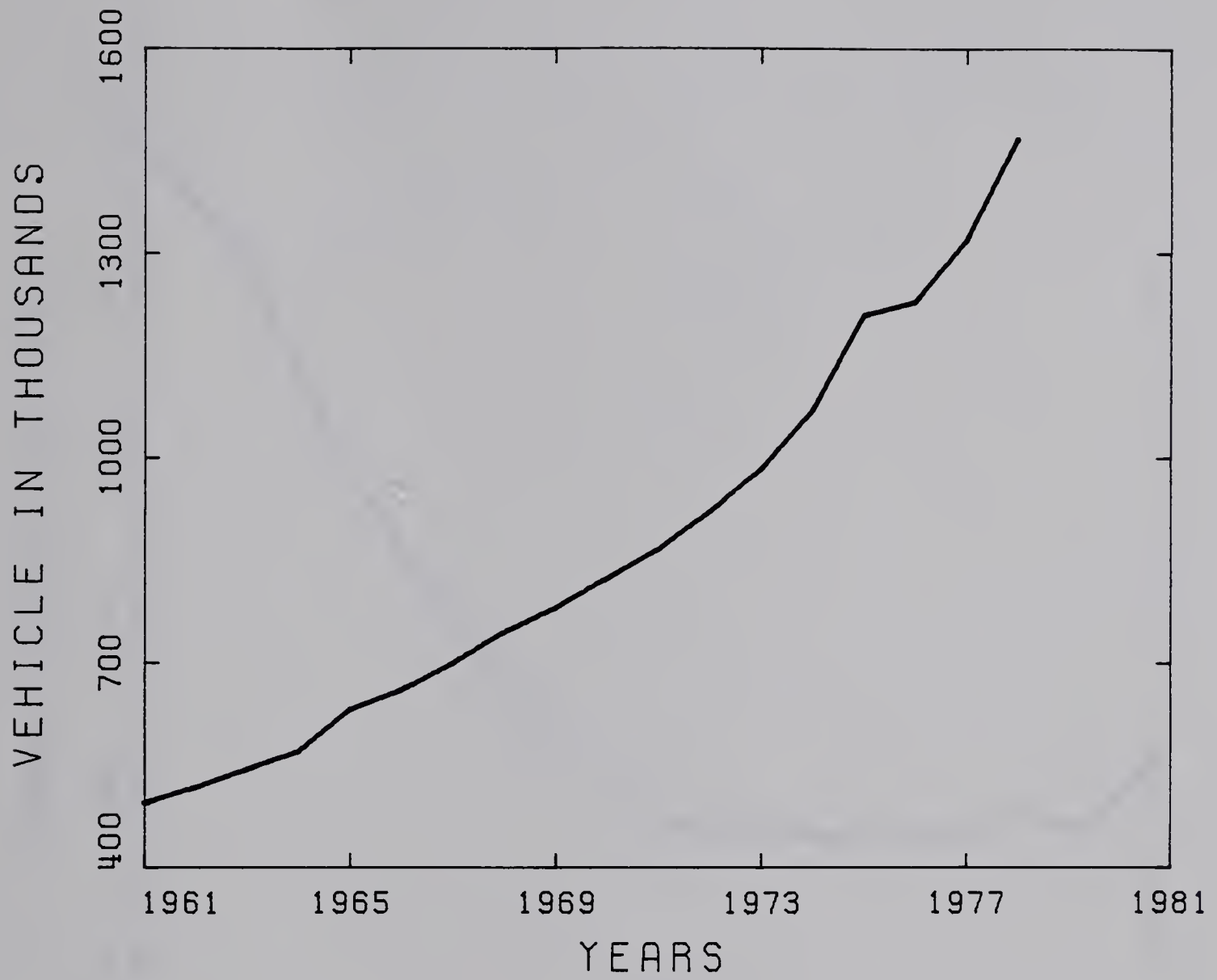


Figure I.2 Total Motor Vehicle Registration in Alberta

Source: Alberta Statistical Review, Annual - 1978. Bureau of Statistics, Alberta Treasury, Table 104, p.109.

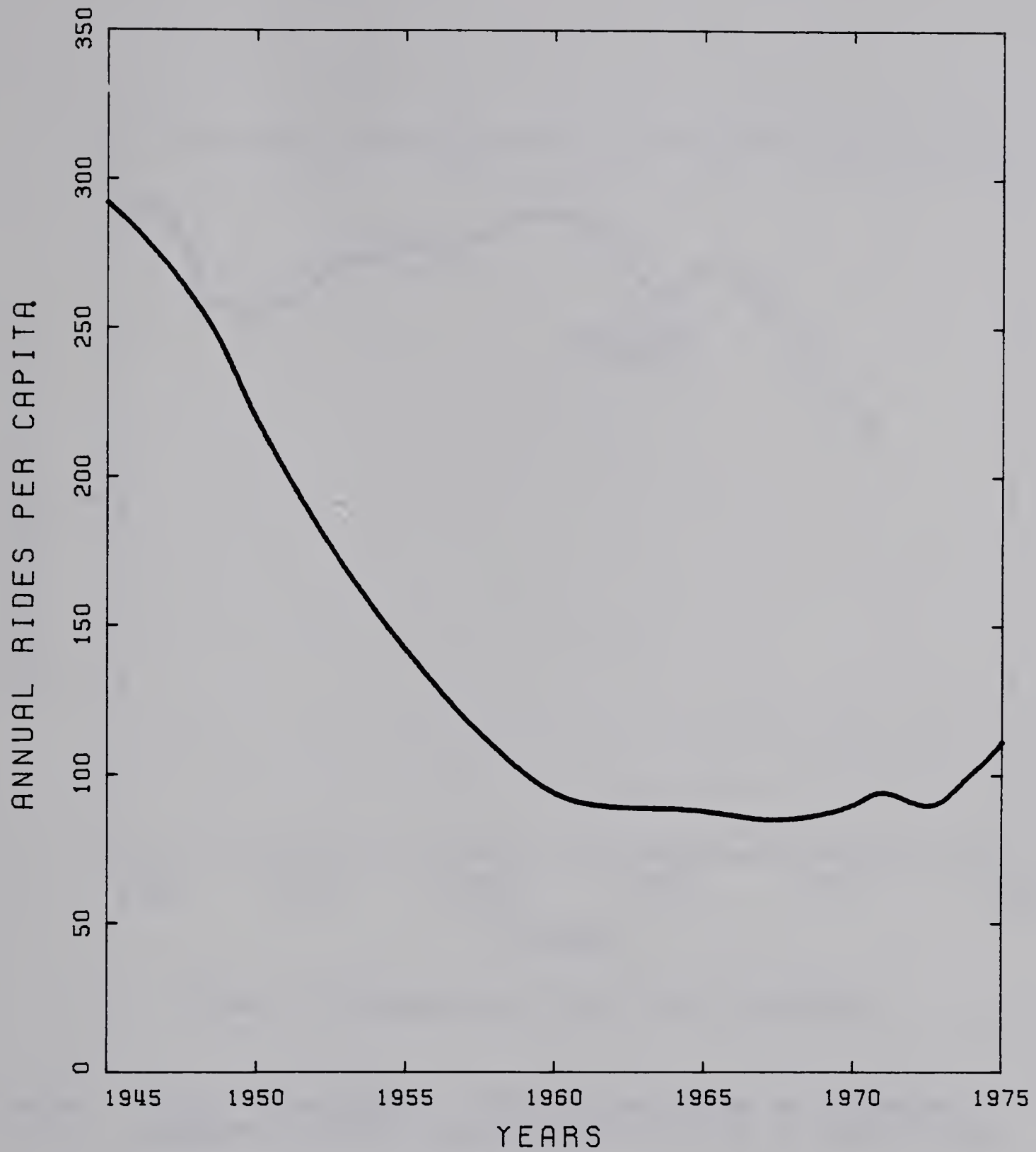


Figure I.3 Transit Patronage Trends in Edmonton

Source: "Rapid Transit Extension Study", Transportation Plan, Part II, Section C, Volume I, Transportation Planning Department, City of Edmonton, January 1977, p.5.

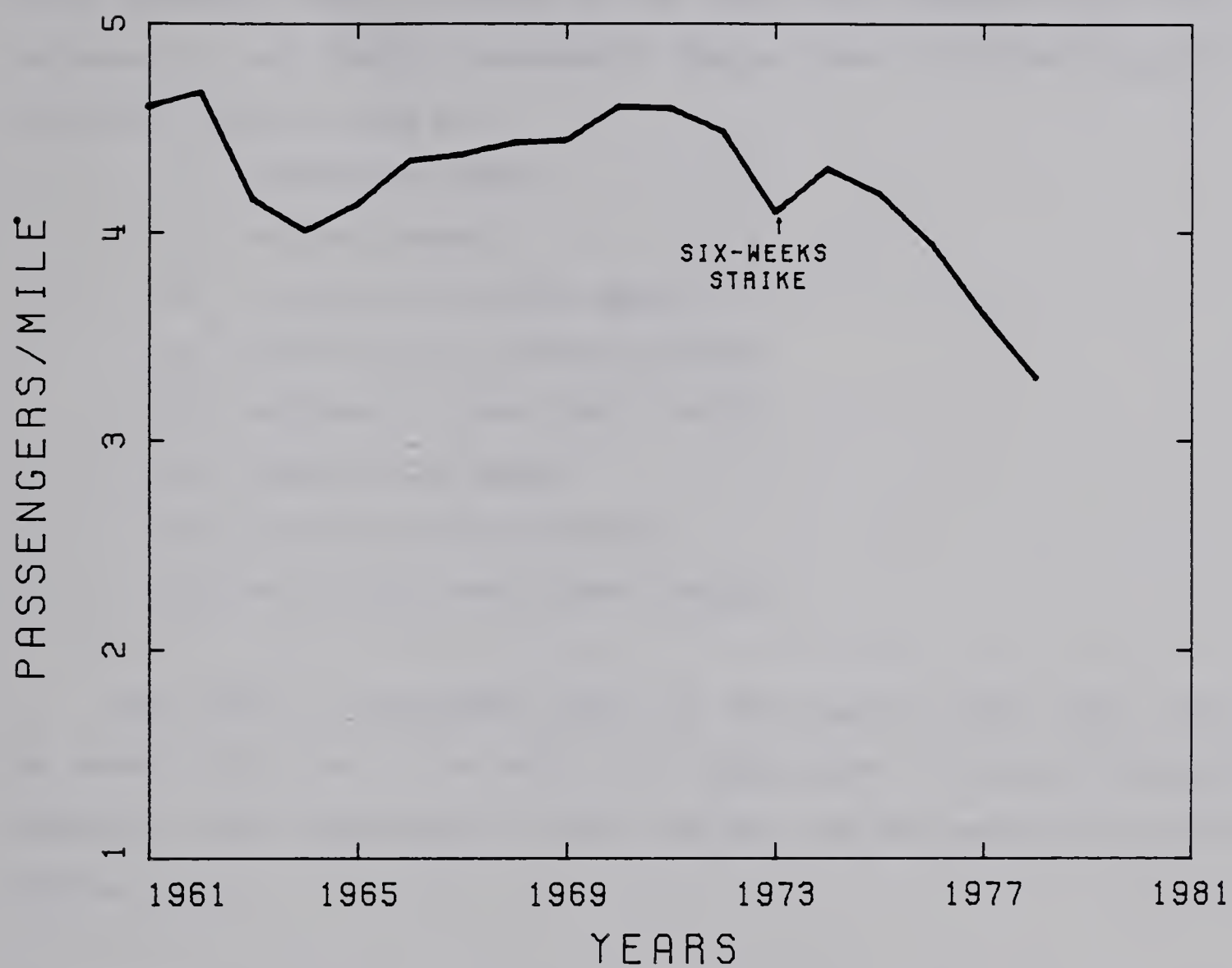


Figure 1.4 Passengers per mile Trends in Edmonton

- Source: 1. "Public Transportation", - Course notes, Edited by J.J. Bakker, Department of Civil Engineering, The University of Alberta, 1978.
2. Edmonton Transit, City of Edmonton.

in mileage within the system due to the expansion of the city.

In order to provide for the efficient operation of the transit system, some transit priority schemes have to be taken into consideration. The idea of giving systematic priority to transit is not new. Some measures have been in existence for many decades, especially in Europe. There are different types of bus priority schemes, such as:

- 1) reserved bus lanes,
- 2) bus-only streets,
- 3) bus priority at traffic signals,
- 4) bus priority for turning movement,
- 5) bus priority in area traffic control,
- 6) priority at bus stops,
- 7) priority access to freeways,
- 8) bus priority through street planning.

This study will concentrate mainly on the area of traffic signal priority for transit. That is not to say that traffic signal priority is the most important scheme for transit operation. The others are also vital and each can lead to an individual study.

A. OBJECTIVES

The basic objective for the implementation of transit priority at signals is to give transit a preferential treatment in order to improve transit services. Related objectives are that this:

- 1) should not cause congestion by developing excessive queues,
- 2) should not seriously reduce the capacity of the intersection,
- 3) should assist the flow of other traffic, if possible,
- 4) should not involve excessive expenditure,
- 5) should be enforceable.

At the beginning of this study, it was intended that a transit corridor in Edmonton (107 Avenue from 101 Street to 124 Street) be simulated through a computer program, *BUSPAS*. The objectives were to:

- 1) identify the existing traffic situation of the proposed corridor,
- 2) simulate the existing traffic condition with the *BUSPAS* program,
- 3) study the delay reduction for transit at signals through various priority schemes,
- 4) investigate how other traffic will be affected,
- 5) evaluate the overall benefit of each scheme,
- 6) recommend the best signal strategy for transit operation.

In the midst of this study, because of the difference in computer operating systems, the *BUSPAS* program could not be executed. The area of study was then changed to an investigation of the transit priority in areawide timing plan. The new objectives were to:

- 1) compare the performance of the timing plans optimized by *TRANSYT* for cases with and without transit priority,
- 2) find to what extent the consideration of transit priority in *TRANSYT* is applicable to Edmonton.

B. ORGANIZATION

Chapter II presents a literature review of the different priority schemes for transit vehicles and the studies related to this topic that have been done in the United States, England, and Edmonton.

Chapter III deals with the components of transit travel time, and presents an investigation of the transit travel time components in Edmonton.

Chapter IV gives a description of the *BUSPAS* computer simulation model, the events that occurred in running the program, and the modification made to the program.

Chapter V describes one of the alternative priority schemes, the off-line optimization technique using *TRANSYT* version 7, and presents the results of a real-life "*before-and-after*" study utilizing this priority treatment strategy in Edmonton.

Finally, Chapter VI presents the conclusions and recommendations arising from this study.

II. LITERATURE REVIEW

A. PRIORITY SCHEMES FOR TRANSIT VEHICLES

A variety of signal priority schemes for transit vehicles have been developed. In summary, there are two basic types – active and passive.

a. Active approach

The active approach requires the actual detection of a transit vehicle in order to make a real-time adjustment to signals. It can be divided into two subsets:

- 1) Unconditional preemption

Preemption is granted whenever a bus requests it or is being detected, subject only to safety intervals, such as pedestrian and vehicular clearances.

- 2) Conditional preemption

Other factors, such as the progression of traffic or the time since last preemption, are also considered to determine when or if a preemption will be granted.

b. Passive approach

The passive approach does not need the requirement set in the active approach. It involves the provision for transit in the design of a signal system in order to aid transit operation. There are five possible ways:

- 1) Signal phase for buses only

On the average, a bus accelerates slower than an automobile. If an advance phase of two to three seconds duration is conferred on buses, sufficient benefit will be gained by getting ahead of other traffic. Of course, this special signal has to be separated from the normal signal so as not to confuse other motorists. In Edmonton, the yellow T or yellow T with a green arrow is used

and is placed higher than the regular signal.

2) Adjustment of cycle length

The delay encountered at a traffic signal is directly related to the cycle length. When the cycle length is increased, so is the delay. This is illustrated in Figure 11.1. A reduction in the cycle length will generally benefit buses. However, consideration should be given to the capacity of the intersection, because capacity will be reduced as the cycle length decreases. If reduced cycle length increases congestion to the intersection, the operation of the buses will eventually be affected.

3) Splitting of phases

In this case, the overall cycle length remains unchanged, but the effective cycle length for buses is reduced. This is demonstrated in Figure 11.2. The normal sequence of the three-phase signal is A-B-C, where the bus movements are through during phase A. If the bus arrives at the end of phase A, it will have to wait for the total time of phase B plus phase C. If we split phase A into two parts and put half between B and C and the other half between C and B, then the buses will only have to wait through either phase B or C. The net result is a reduction of cycle length for vehicles in phase A.

4) Timing plans

The method used by most traffic engineers in designing a signal timing plan is based on minimizing vehicular delay. If the criterion of passenger delay is used instead, buses should be granted a progression favouring them, simply because buses carry more passengers than private cars. The off-line computer optimization program, *TRANSYT* version 5, has a facility to give preferential progression to bus movements.

5) Metering of vehicles

Metering is a form of traffic control that regulates the flow of

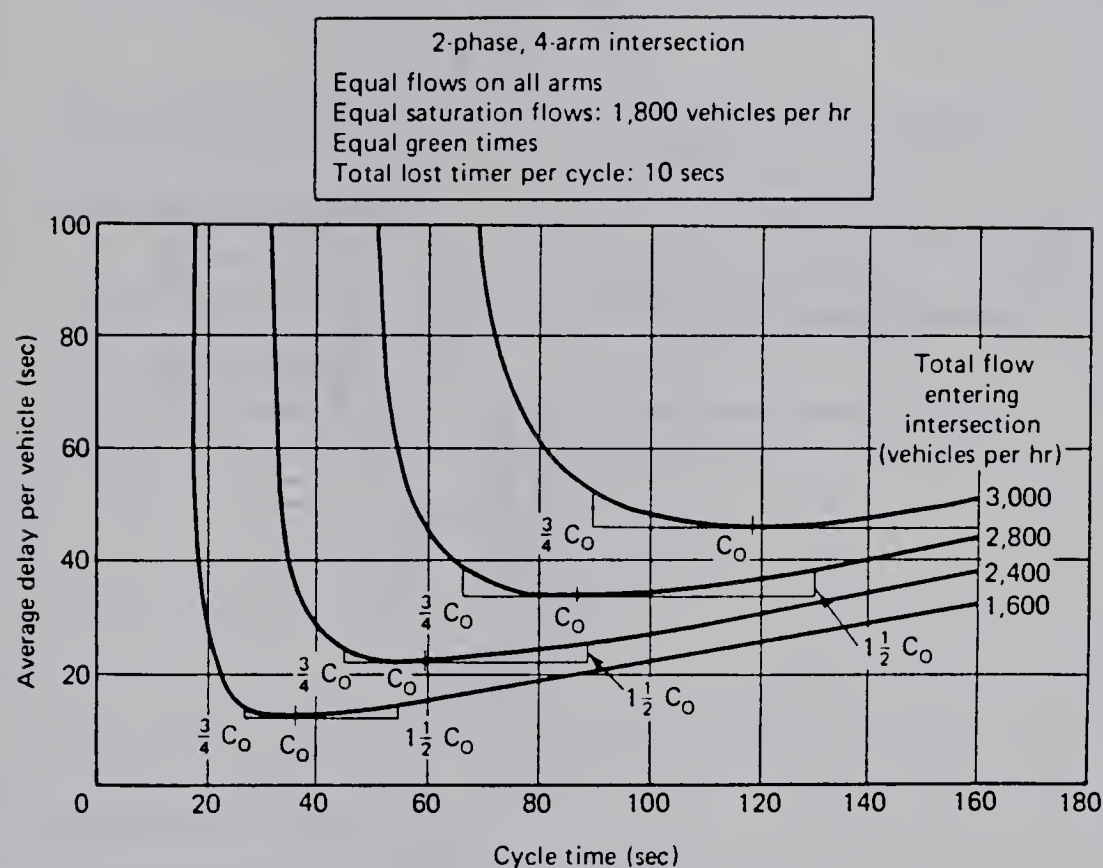


Figure II.1 Effect on Delay of Variation of Cycle Length

Source: F.V. Webster and B.M. Cobbe, "Traffic Signals", Road Research Technical Paper No. 56, London, England : Her Majesty's Stationery Office, 1966, p.58.

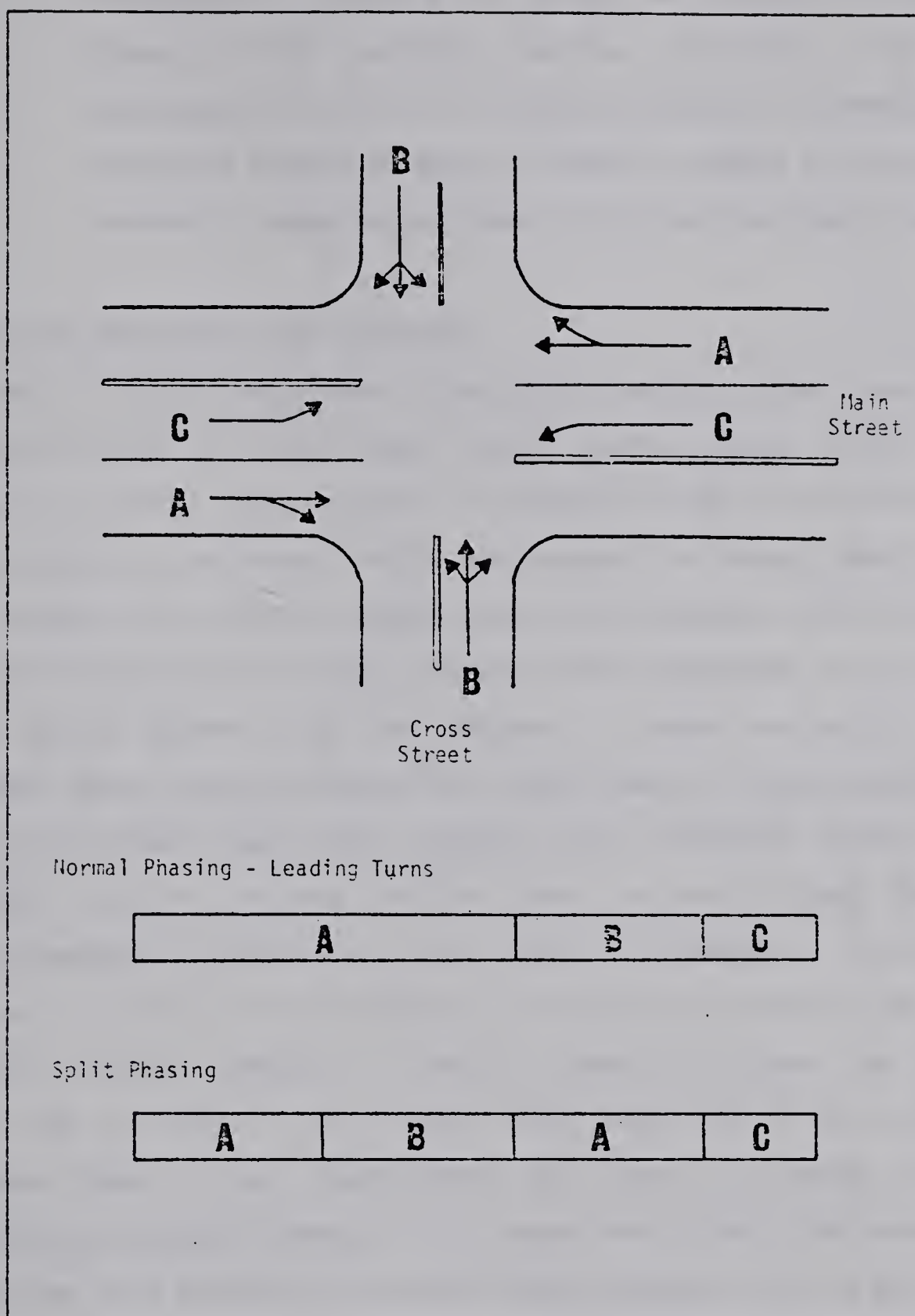


Figure II.2 A Schematic Diagram showing the Splitting of Phases

Source: Thomas Urbanik II, "Priority Treatment of Buses at Traffic Signals", *Transportation Engineering*, November 1977, p.32.

traffic through an intersection from one or more directions. It is analogous to *throttling* or *gating*. An example is exhibited in Figure II.3. By controlling the flow of traffic at the metering intersection, the flow at a critical intersection downstream will be improved. Priority is given to buses by means of a bus lane and perhaps a special signal phase to go past the gating intersection.

B. PREVIOUS RESEARCH AND STUDIES

Back in 1970, a large scale urban traffic control project was conducted in the United States (1). In this Urban Traffic Control System (*UTCS*), computers were used to control traffic signals in a portion of the city. Information about volume, occupancy, and queue lengths was supplied by vehicle detectors on the streets. Timings for fixed-time signals were then selected by the computer and pulses were transmitted to replace the dial drum mechanisms in the controllers. The Bus Priority System (*BPS*) was designed to function as part of the *UTCS*. The signals along some bus routes had cycle times and splits selected by the traffic control system. Buses were equipped with a transmitter which could send two codes, one for stopping and the other for non-stopping. Before each "*priority-equipped*" intersection, there were two detectors. The bus driver would notify the *BPS* on the stopping or non-stopping status of the bus upon passing the upstream detector. As long as it had not crossed the downstream detector just in front of the stopline, *BPS* knew that it had not left the intersection. Based on past measurements, *BPS* knew the chances were that a bus passing the upstream detector at a certain time in the cycle would be able to make use of a priority. One second before the end of the green phase for the priority direction, the side street queue was checked against predetermined thresholds; if they were exceeded, no priority was given. Then the number of bus passenger seconds saved minus the cross-street auto passenger seconds lost was estimated; if the gain was positive and the bus was still located in

1 Sperry Rand Corporation, Sperry Systems Management Division, "Advance Control Technology In Urban Traffic Systems", Vol. 1A, "Bus Priority System Description", Great Neck, N.Y. 1970.

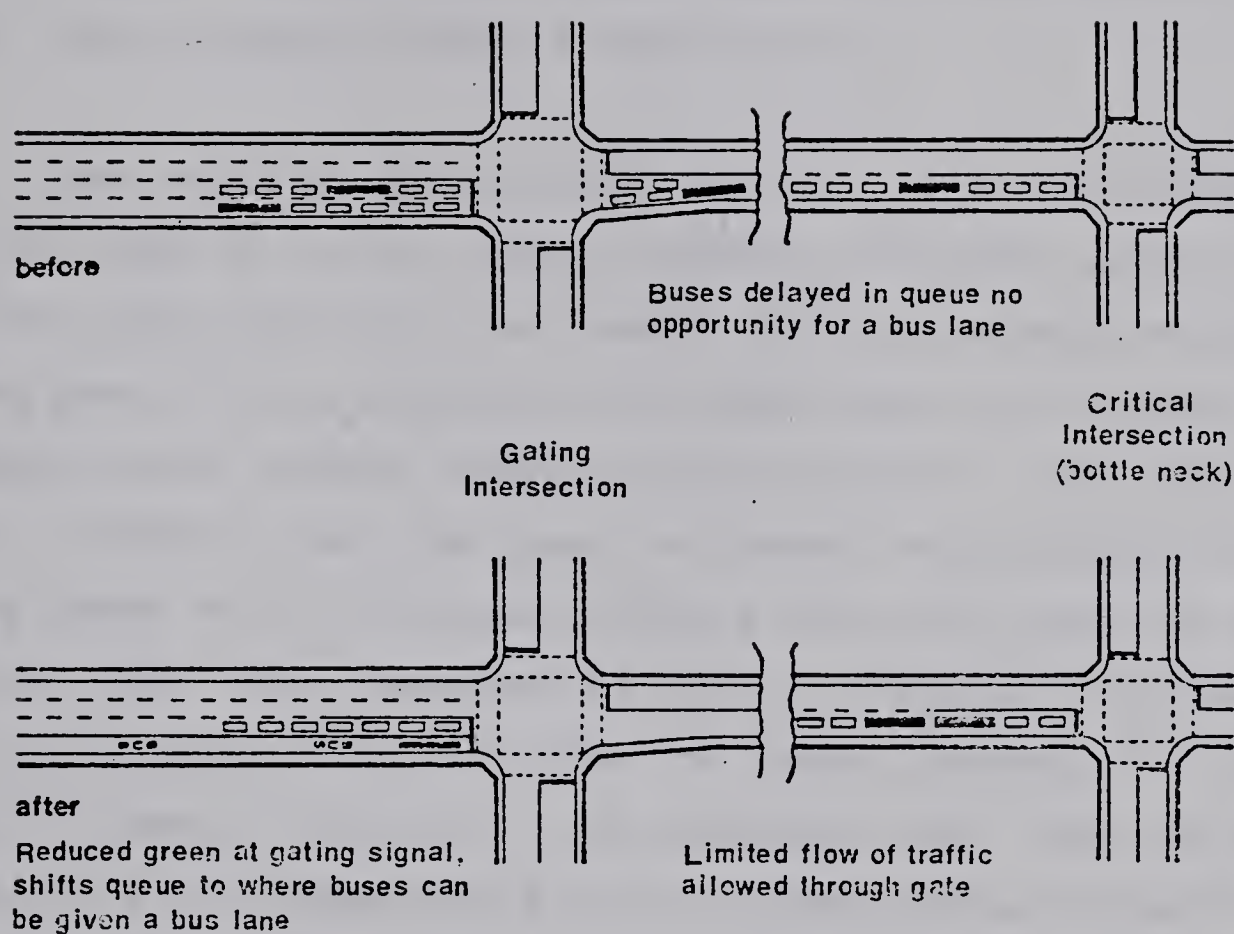


Figure II.3 Gating as a Bus Priority Measure

Source: "Bus Lanes and Busway Systems", A Report prepared by the Organization for Economic Co-operation and Development (OECD) Research Group, December 1976, p.35.

between the detectors, a priority of pre-selected length up to 10 seconds was granted.

Initial results of the experiment indicated that the *BPS* algorithm was too restrictive to result in a significant improvement in bus operations - a total savings of about two to three minutes travel time per bus helped in the network, with an average of one bus helped per hour.

A less restrictive algorithm was used in a experiment conducted by Evans and Skiles (2) in Los Angeles, California. The priority scheme was to extend the green signal for transit vehicles, either as an early termination of opposing green or as a lengthening of the green phase in the direction of the approaching transit vehicles. Extensions were subject to time limits which ensured a minimum cross-street green. The scheme was simulated by manually changing signals at two intersections along a bus route; about half the bus route red signals were preempted. Bus delays, occupancies, and cross-street delays were recorded with and without the priority simulation. In a six-hour period, the observed reductions in bus passenger delays were 70 and 76 percent at the two intersections, but the cross-street delays increased 51 and 24 percent respectively. In terms of the total intersection passenger delay, there was a reduction of nearly 15 percent at one intersection and 43 percent at the other one. This experiment proved that traffic signal priority could in fact improve transit service and the performance of some intersections in terms of passenger delay.

In 1972, a demand-responsive system was tested at Leicester (3), England. An intersection traffic controller was instrumented to respond to signals transmitted from bus-mounted transponders via a pavement selective vehicle loop. An exclusive right-turn phase (which corresponds to the left-turn phase in

2 Henry K. Evans and Gerald W. Skiles, "Improving Public Transit Through Bus Preemption of Traffic Signals", *Traffic Quarterly*, October 1970, p.531.

3 L.E. Richbell and B.A. Van Averbek, "Bus Priorities At Traffic Control Signals", *Traffic Engineering And Control*, June 1972, p.70.

North America) was given 6 to 10 seconds of advance green from one of two other phases. Buses were timed through the intersection with and without priority. On the average, the priority scheme saved between 12 and 15 seconds per bus trip through the intersection. Also, a 30-second gain would result if maximum priority, including phase skipping, had been awarded to buses. This experiment showed that special vehicle detection of buses was possible.

In an experiment conducted in Woking (4), England, it was demonstrated that a standard loop detector could also be used to detect buses. A standard loop detector was placed in front of the stopline of a "bus-only" lane. Whenever a vehicle was detected, it interrupted the normal operation of the signal controller and changed to the demanded stage as quickly as possible by curtailing the green time in the other stages. The algorithm restriction was that minimum green times were not curtailed. Testing results showed that time savings to buses were small: 7 seconds or less in mean journey time.

At more or less the same time, a study of the bus priority schemes was conducted by Michalopoulos (5) in Miami, Florida. The signals were preempted upon bus arrival means of an optical preemption device. A high intensity light beam was transmitted by an emitter installed on the bus; this activated a receiver at the intersection which in turn sent a signal out to the controller. The detection distance was variable up to 1800 feet. If the signal was green when the bus was detected, it held green for the bus up to a maximum of 90 seconds. If the signal was red, a green phase was given as soon as the minimum cross-street green had been displayed. After the bus left the intersection, right of way was transferred to the cross-street immediately and normal operations resumed. Testing results showed that travel time was reduced by 25 percent through preemption, and the creation of a bus lane further lowered it by 8 percent. This experiment also took comfort measures

4 K. Wood, "Survey of Bus Priority at Traffic Light Signals in Woking", *The Transport and Road Research Laboratory*, SR 228, 1976.

5 Panos G. Michalopoulos, "Bus Priority System Studies", *Traffic Engineering*, July 1976, p.46.

(in terms of speed noise, speed changes, number of stops) and fuel consumption into consideration, which both showed consistent improvement.

In Edmonton, a similar system was implemented from 1974 to 1979. A frequency preemption device was used to actuate a bus crossing signal. This system was usually installed at a *STOP* approach of a collector road - arterial road type of intersection. One such location was on 57 Avenue and 111 Street. Upon approaching the intersection, the bus driver activated a small transmitter and a radio frequency was emitted to the local controller. The controller would then terminate the green phase on the main road so that the bus could get onto or cross the main road. These signals also served as pedestrian-actuated crossing signals. The reasons for the termination of this system were: firstly, the failure rate of the system was high; secondly, the drivers did not return the small transmitters and the transit system lost control over the operation.

An improved system for the detection of buses only had been successfully developed in Edmonton. No special on-board equipment was required in this system (6). All it involved was a standard inductive loop detector and a special discrimination decision algorithm written as a microprogram for a microcomputer. This algorithm recognized the "*signatures*" of buses, i.e. signal outputs caused by the inductance changes in the loop during the passage of buses, through a pre-determined logic involving the number of peaks, their relative magnitudes, and the position of the peaks. The operating reliability of this system was as high as 100 percent. At the present time, five locations in the peripheral areas of Edmonton are being equipped with this system.

The five experiments mentioned above prove that special detection of

6 L. Cheng, J. Schnablegger and S. Teply, "Transit Priorities and Development of a Passive Bus Detection System in Edmonton", *Traffic Engineering and Control* February 1980, p.522.

buses can be done with existing technology. All that matters is the cost of equipment and its cost-effectiveness.

Computer simulations have become more and more popular in the last decade due to the rapid advancement of electronic technology. The main advantages of simulation are that, firstly, testing can be done in the office without the risk of actually building or implementing the system in the field, which may be expensive and time-consuming, and, secondly, the alternatives can be tested under identical conditions which are impossible to obtain in the field. A necessary condition for simulation is a good fit of the models used to test the real-life traffic performance.

A simulation model has been developed in the Transport and Road Research Laboratory, England, to assess bus priority techniques. It is called the BUS Priority Assessment Simulation (*BUSPAS*). The details of the model will be discussed in a later chapter. In a report by K. Wood (7), the predictions from the *BUSPAS* program were compared with some field data at two cities, Woking and Walsall, in England. The range of the travel time measured was between 15 and 42 seconds. Most of the predicted changes in mean travel time of buses and other traffic were within 2 seconds of the observed ones; the worst was within 5 seconds.

Another study using a traffic simulation program, called the *SCOT* model (Simulation of Corridor Traffic), was conducted by Lieberman, Muzyka, and Schmeider (8) in Minneapolis, Minnesota. The results indicated that the reduction in delay for bus passengers outweighed the additional delay experienced by

7 K. Wood, "Bus-Actuated Signal Control at Isolated Intersections : A Simulation Model", *The Transport and Road Research Laboratory*, SR 373, 1978.

8 E.B. Lieberman, A. Muzyka and D. Schmeider, "Bus Priority Signal Control : Simulation Analysis of Two Strategies", *Transportation Research Record* 663, 1978, p.26.

private cars at intersections. A recent report by Vincent, Cooper, and Wood (9), using the *BUSPAS* program, also concluded with a similar finding.

All these demonstrate that a validated simulation model is an effective tool for evaluating bus priority schemes without the high costs incurred by actual measurements in the field.

9 R.A. Vincent, B.R. Cooper, and K. Wood, "Bus-Actuated Signal Control at Isolated Intersections - Simulation Studies of Bus Priority", *The Transport and Road Research Laboratory*, LR 814, 1978.

III. TRANSIT TRAVEL TIME

A. INTRODUCTION

The elements of a transit trip are:

- 1) the walking time from the place of origin to the bus stop,
- 2) the waiting time at the bus stop,
- 3) the in-vehicle time required to travel from the boarding bus stop to the destined bus stop,
- 4) the transfer time associated with this trip if there is any, and
- 5) the walking time from the alighting bus stop to the final destination.

In a survey done in Edmonton (10), it was found that waiting had the greatest disutility, followed by walking and transferring. In-vehicle time appeared to have the least factor weighting. In a separate study by Gill (11), it was found that in Edmonton waiting time is not dependent on the frequency of service but on the reliability of service and a good knowledge of the schedule. Schedule reliability is the prime factor in the successful operation of Edmonton's transit system, which employs a time-transfer concept. That is to say, in order to make a time-transfer system work, it is necessary to maintain a reliable transit travel time.

In the case of transit travel time, its components are:

- 1) loading and unloading of passengers,
- 2) actual travel along the route,
- 3) delays caused by traffic control devices, and
- 4) congestion along the streets.

10 The Transportation Plan, Part III, Volume I, Engineering and Transportation Department, *The City of Edmonton*, December, 1976.

11 J.W. Gill, "Density Of Bus Service In North Edmonton", M.Sc. Thesis, *The University Of Alberta*, 1969.

The relative contribution of these components to total travel time varies widely from city to city, as illustrated in Figure III.1. In order to have a clear understanding of the situation in Edmonton, a survey of the transit travel time was conducted on 107 Avenue.

B. OBJECTIVE OF THE SURVEY ON 107 AVENUE

The objective of the transit travel time survey on 107 Avenue was to investigate the percentage breakdown of each delay element, which would give a better knowledge of what constitutes travel time. This survey also provided necessary information for the simulation of buses in the *BUSPAS* program later on.

C. THE TRANSIT TRAVEL TIME SURVEY

a. Definitions

Before discussing the survey, there are a number of terms which should be defined:

1) Travel time

The total time it takes for a vehicle to travel over a section of roadway.

2) Running time

The time during which a vehicle is in motion.

3) Operating speed

The distance travelled by a vehicle divided by the travel time, which includes running time, stopping time at stations, and delays for traffic reasons.

4) Running speed

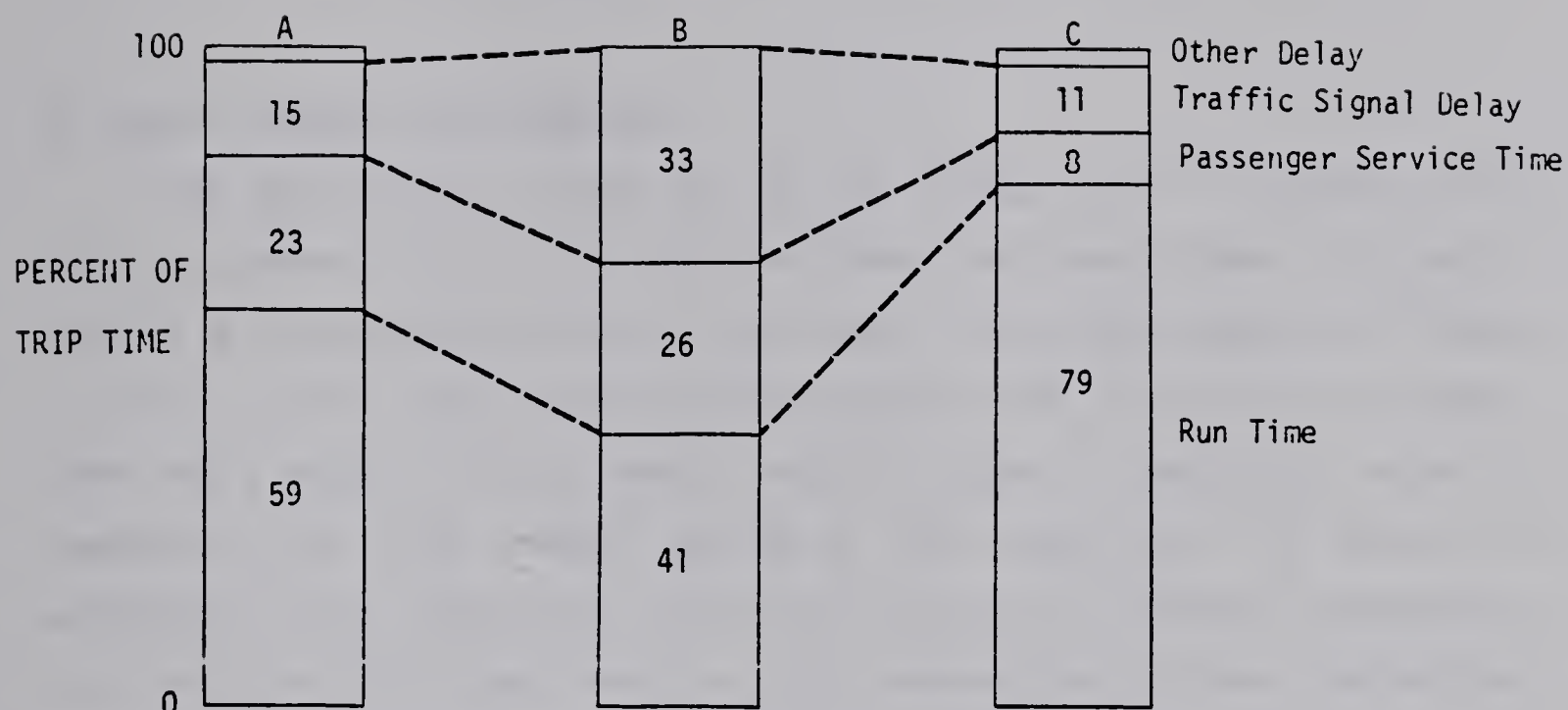
The distance travelled by a vehicle divided by the running time.

5) Stopped-time delay

The delay during which the vehicle is standing still.

6) Passenger dwell time

The time required to discharge and take on passengers at a bus



- A: Washington, D.C. Buses on 16th Street between I and U streets July 10, 1962. Total of 59 runs in peak hour.
- B: Toronto, Ontario. Buses on Bay Street between Adelaide and King Streets, March 1, 1974. Total of 39 runs in peak hour.
- C: Toronto, Ontario. Streetcars on King route, June 6, 1973. Total of 271 runs over entire day. Run times computed as scheduled times less recorded delay times.

Figure III.1 Breakdown of Public Transit Trip Times

Source: Duncan W. Allen, "Signal Priority for Transit Vehicles", Research Report No. 34, University of Toronto - York University, May 1976, p.3.

stop, including opening and closing doors and time spent standing.

Figure III.2 is a graph showing the interpretation of these terms.

b. Survey location and condition

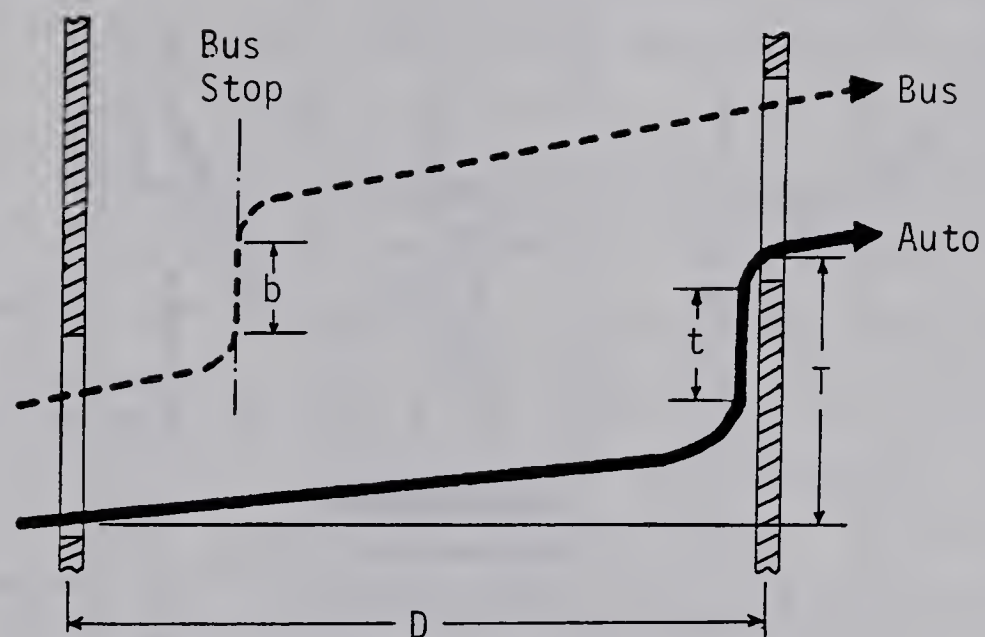
The study corridor chosen was on 107 Avenue from 101 Street to 124 Street, as shown in Figure III.3. Data were taken on Transit Routes 3, 4, and 7. Route 4 is in operation only during peak hours. The control section for Routes 3 and 4 is from 106 Avenue and 101 Street to 108 Avenue and 124 Street, which has a length of 3152 meters, while for Route 7, the control section is measured to be 3080 meters, starting at 106 Avenue and 101 Street and terminating at 107 Avenue and 125 Street. There are six signalized intersections and twenty-five bus stops within the study corridor. The signalized intersections operate in isolation and are fully actuated by vehicles, except for the one at 113 Street which is semi-actuated.

Data were collected under various weather conditions during weekdays in order to reflect the general transit travel pattern. All the delays measured in this survey were stopped-time delays. The stopped-time delay was utilized because it is easy to measure, although it underestimates the *actual* delay or *approach* delay by about 24 percent (12).

c. Survey methodology

The observer occupied a seat in the front of the bus in order to view the traffic conditions clearly and to measure the delays accurately. As the test run began, the observer started one stop watch which was used to read the total travel duration from the beginning to the end of the study route. Two

12 W.R. Reilly, G.C. Gardner, and J.H. Kell, "A Technique for Measurement of Delay at Intersections", *Federal Highway Administration Report 76-135, Vol.1*, Washington, 1976.



Legend:

T = Travel Time

t = Stopped-time Delay

b = Passenger Dwell Time

D = Distance of Roadway

$T-t$ = Running Time

$\frac{D}{T}$ = Operating Speed

$\frac{D}{T-t}$ = Running Speed

Figure III.2 A Time-space Diagram showing the Graphical Interpretation of Traffic Terms



Figure III.3 A Map of the City of Edmonton

more stop watches were used for reading the passenger boarding and alighting time and other stopped-time delays which occurred along the transit route. All the readings were recorded on a field sheet.

D. DATA ANALYSIS AND DISCUSSION

The travel time data were then converted into speed. Both the operating speed and the running speed were computed in each test run. These figures are displayed in Tables III.1 to III.6, and the summary of these results is shown in Tables III.7, III.8, and III.9.

Significance testing was then applied to the running speed data, which is presented in Appendix I. In the AM, Off, and PM peak studies, it was found that there was no difference in running speed between the diesel and trolley buses at a 95 percent confidence level. Also, there was no significant difference at a 95 percent confidence level between the eastbound and westbound running speeds, except during the morning peak. Perhaps this was due to the fact that on 107 Avenue during the morning peak there was more traffic going eastbound than westbound. This higher volume increased the cohesion among the flow, causing a lower running speed for the eastbound traffic, while for the off-peak and afternoon peak hours, the eastbound and westbound traffic had a close directional split.

The percentage breakdown of transit travel time is illustrated in Figure III.4. The delay at signals accounted for 13.2, 18.6, and 20.0 percent of the transit travel time in the AM, Off, and PM peaks respectively. The detailed components of stopped-time delay are presented in Figures III.5 to III.8. It was found that the delay at signals was the major component of all the delays. It constituted 35.4, 47.7, and 48.8 percent of the total stopped-time delay for the AM, Off, and PM peaks respectively. These figures support the need to reduce the delay at signals for transit vehicles.

AM EASTBOUND			
DIESEL		TROLLEY	
OPERATING SPEED (km/h)	RUNNING SPEED (km/h)	OPERATING SPEED (km/h)	RUNNING SPEED (km/h)
13.8	22.7	13.2	25.1
12.4	20.9	13.6	23.8
15.3	24.0	16.4	25.2
18.5	25.5	17.0	24.4
15.7	24.3	12.0	20.6
13.4	19.1	15.5	26.7
16.7	25.0	14.4	21.9
16.4	24.5	13.1	23.4
17.0	26.3	11.4	25.6
18.0	26.3	12.1	22.1
14.8	25.3	13.1	23.6
17.3	25.4		

Table III.1 Summary of the Transit Operating and Running Speeds (AM Peak Eastbound)

AM WESTBOUND			
DIESEL		TROLLEY	
OPERATING SPEED (km/h)	RUNNING SPEED (km/h)	OPERATING SPEED (km/h)	RUNNING SPEED (km/h)
17.3	28.9	15.1	24.5
16.5	25.0	14.0	26.3
19.2	28.2	19.6	28.6
17.5	26.9	19.6	30.8
18.0	26.5	16.8	25.6
16.0	31.6	17.3	23.6
17.2	25.8	19.8	29.4
19.3	29.1	17.1	27.4
19.2	25.3	16.8	25.1
		19.6	28.6

Table III.2 Summary of the Transit Operating and Running Speeds (AM Peak Westbound)

OFF-PEAK EASTBOUND	
DIESEL	
OPERATING SPEED (km/h)	RUNNING SPEED (km/h)
12.8	25.1
16.5	26.3
16.1	28.6
16.3	25.2
16.0	27.8
15.8	25.7
18.0	28.2
14.1	25.4
20.2	29.6
16.0	25.2
13.4	25.2
16.3	24.2
14.5	27.3
18.8	29.2
16.2	28.2
19.3	30.0
16.8	26.5
14.2	24.2
19.8	27.4
17.4	27.2

Table III.3 Summary of the Transit Operating and Running Speeds (Off Peak Eastbound)

OFF-PEAK WESTBOUND	
DIESEL	
OPERATING SPEED (km/h)	RUNNING SPEED (km/h)
12.6	23.1
18.4	27.6
17.1	24.9
16.0	25.3
17.0	29.9
14.0	24.3
16.3	28.3
16.8	27.1
19.6	28.3
19.1	28.9
18.2	29.0
16.0	26.2
18.4	26.5
17.4	29.7
17.1	28.4
17.8	32.7
20.4	31.9
18.2	30.7
17.5	28.7

Table III.4 Summary of the Transit Operating and Running Speeds (Off Peak Westbound)

PM EASTBOUND			
DIESEL		TROLLEY	
OPERATING SPEED (km/h)	RUNNING SPEED (km/h)	OPERATING SPEED (km/h)	RUNNING SPEED (km/h)
13.5	22.9	14.9	23.6
15.0	24.0	13.1	24.8
16.1	26.1	13.4	26.6
16.1	24.1	19.9	29.8
13.8	24.2	14.1	24.0
11.5	23.3	12.0	21.7
14.8	24.8	13.6	26.8
18.7	26.4	9.9	20.6
16.7	28.1	18.4	29.7
14.6	25.8		
15.5	26.9		
19.9	30.6		

Table III.5 Summary of the Transit Operating and Running Speeds (PM Peak Eastbound)

PM WESTBOUND			
DIESEL		TROLLEY	
OPERATING SPEED (km/h)	RUNNING SPEED (km/h)	OPERATING SPEED (km/h)	RUNNING SPEED (km/h)
14.6	26.2	19.2	27.5
12.8	20.8	19.7	29.8
15.7	25.1	18.2	27.1
16.4	24.1	15.4	26.0
14.8	27.8	16.2	27.3
14.0	25.4	15.4	22.8
16.7	26.6	22.8	32.5
15.2	26.2	11.1	22.3
9.4	16.7	17.3	26.5
15.5	26.0	23.5	32.1
		9.8	18.2
		18.7	29.1
		12.2	23.2

Table III.6 Summary of the Transit Operating and Running Speeds (PM Peak Westbound)

		Operating Speed (km/h)	Running Speed (km/h)
AM EASTBOUND	Diesel n = 12	x = 15.78 s = 1.90	x = 24.11 s = 2.19
	Trolley n = 11	x = 13.80 s = 1.83	x = 23.85 s = 1.80
	Diesel plus trolley n = 23	x = 14.83 s = 2.08	x = 23.99 s = 1.98
AM WESTBOUND	Diesel n = 9	x = 17.80 s = 1.22	x = 27.48 s = 2.16
	Trolley n = 10	x = 17.57 s = 2.05	x = 26.99 s = 2.34
	Diesel plus trolley n = 19	x = 17.68 s = 1.66	x = 27.22 s = 2.21
AM both ways, both diesel and trolley n = 42		x = 16.12 s = 2.37	x = 25.45 s = 2.62

Table III.7 Summary of the Mean and Standard Deviation for Transit
Operating and Running Speeds (AM Peak)

		Operating Speed (km/h)	Running Speed (km/h)
OFF-PEAK	Eastbound (Diesel only) n = 20	x = 16.43 s = 2.06	x = 26.83 s = 1.78
	Westbound (Diesel only) n = 19	x = 17.26 s = 1.83	x = 27.97 s = 2.53
OFF-PEAK Both ways n = 39		x = 16.83 s = 1.97	x = 27.38 s = 2.22

Table III.8 Summary of the Mean and Standard Deviation for Transit
Operating and Running Speeds (Off Peak)

		Operating Speed (km/h)	Running Speed (km/h)
PM EASTBOUND	Diesel n = 12	x = 15.52 s = 2.26	x = 25.60 s = 2.21
	Trolley n = 9	x = 14.37 s = 3.08	x = 25.29 s = 3.23
	Diesel plus trolley n = 21	x = 15.02 s = 2.64	x = 25.47 s = 2.62
PM WESTBOUND	Diesel n = 10	x = 14.51 s = 2.12	x = 24.49 s = 3.32
	Trolley n = 13	x = 16.88 s = 4.16	x = 26.49 s = 4.07
	Diesel plus trolley n = 23	x = 15.85 s = 3.57	x = 25.62 s = 3.82
PM Both ways, both diesel and trolley n = 44		x = 15.46 s = 3.15	x = 25.55 s = 3.26

Table III.9 Summary of the Mean and Standard Deviation for Transit
Operating and Running Speeds (PM Peak)

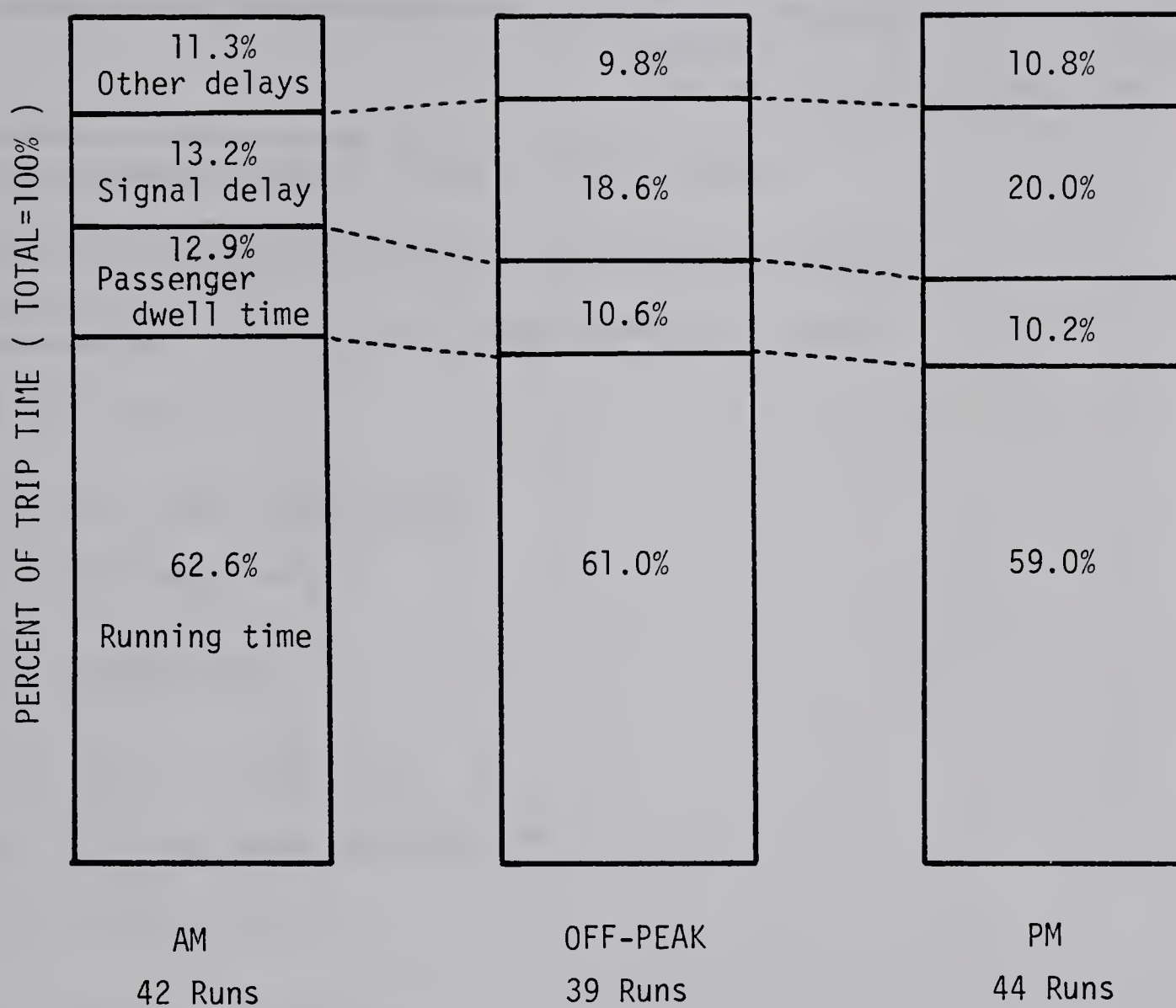
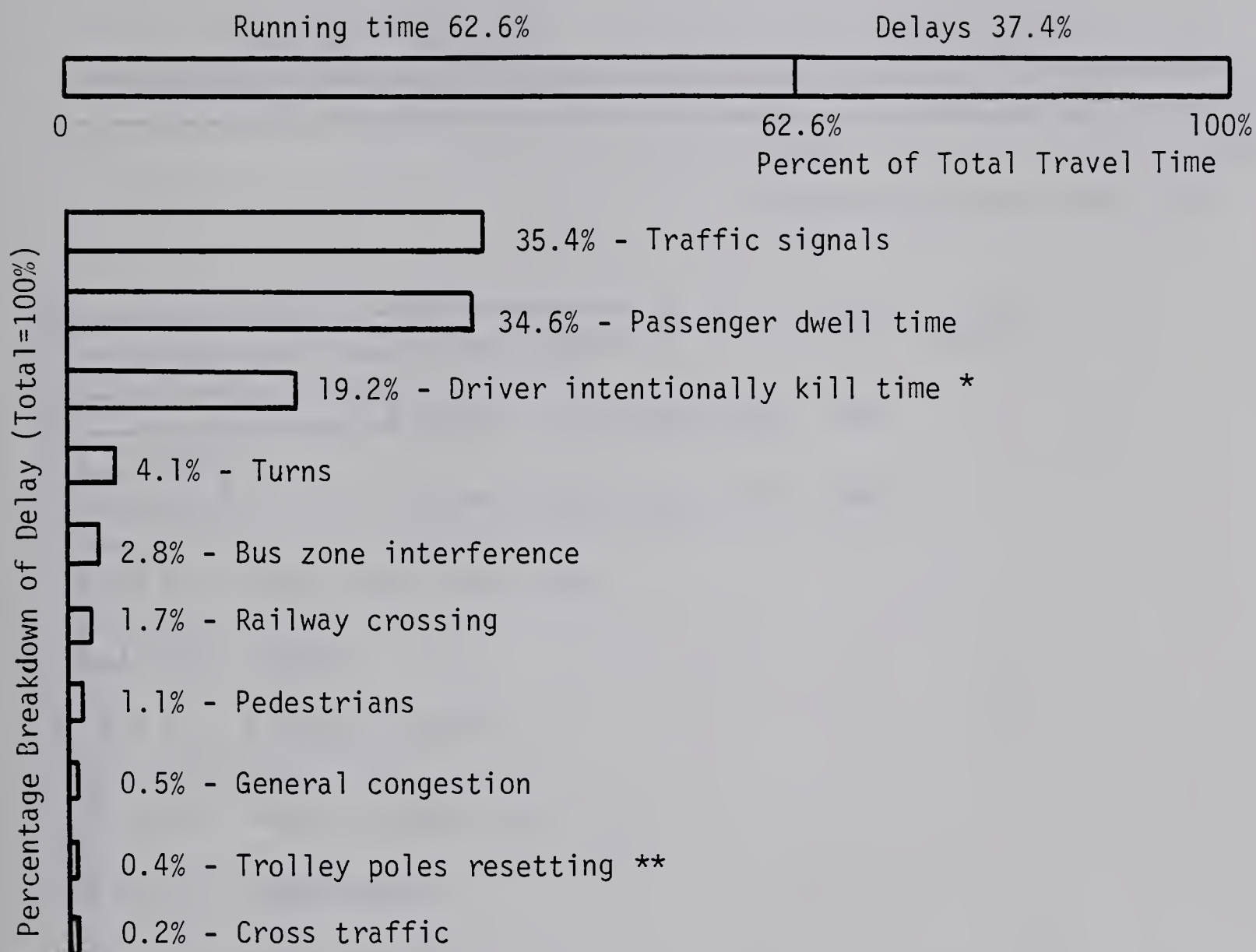


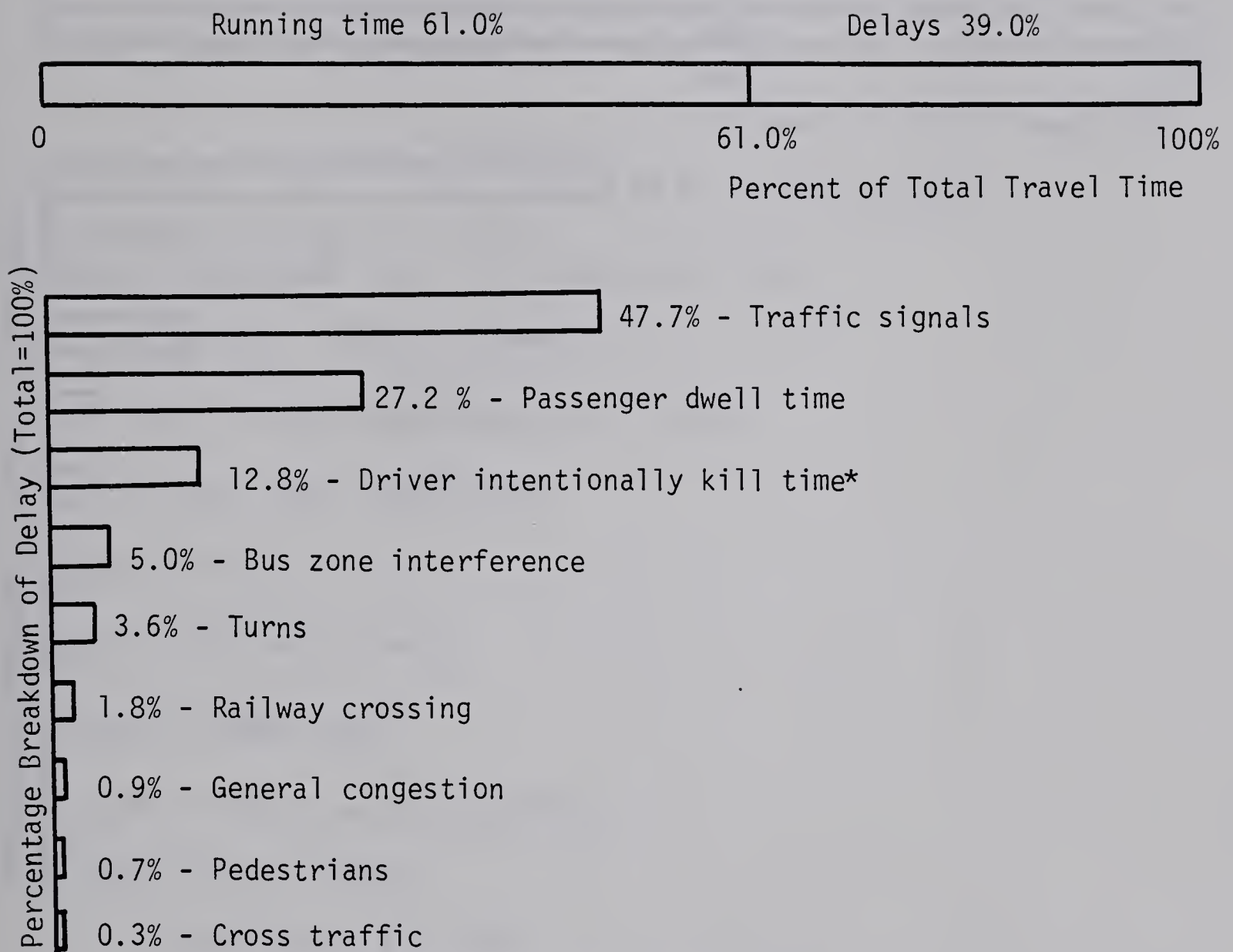
Figure III.4 Percentage of Transit Travel Time Components on 107 Avenue from 101 Street to 124 Street



* Layover at Bus Stops

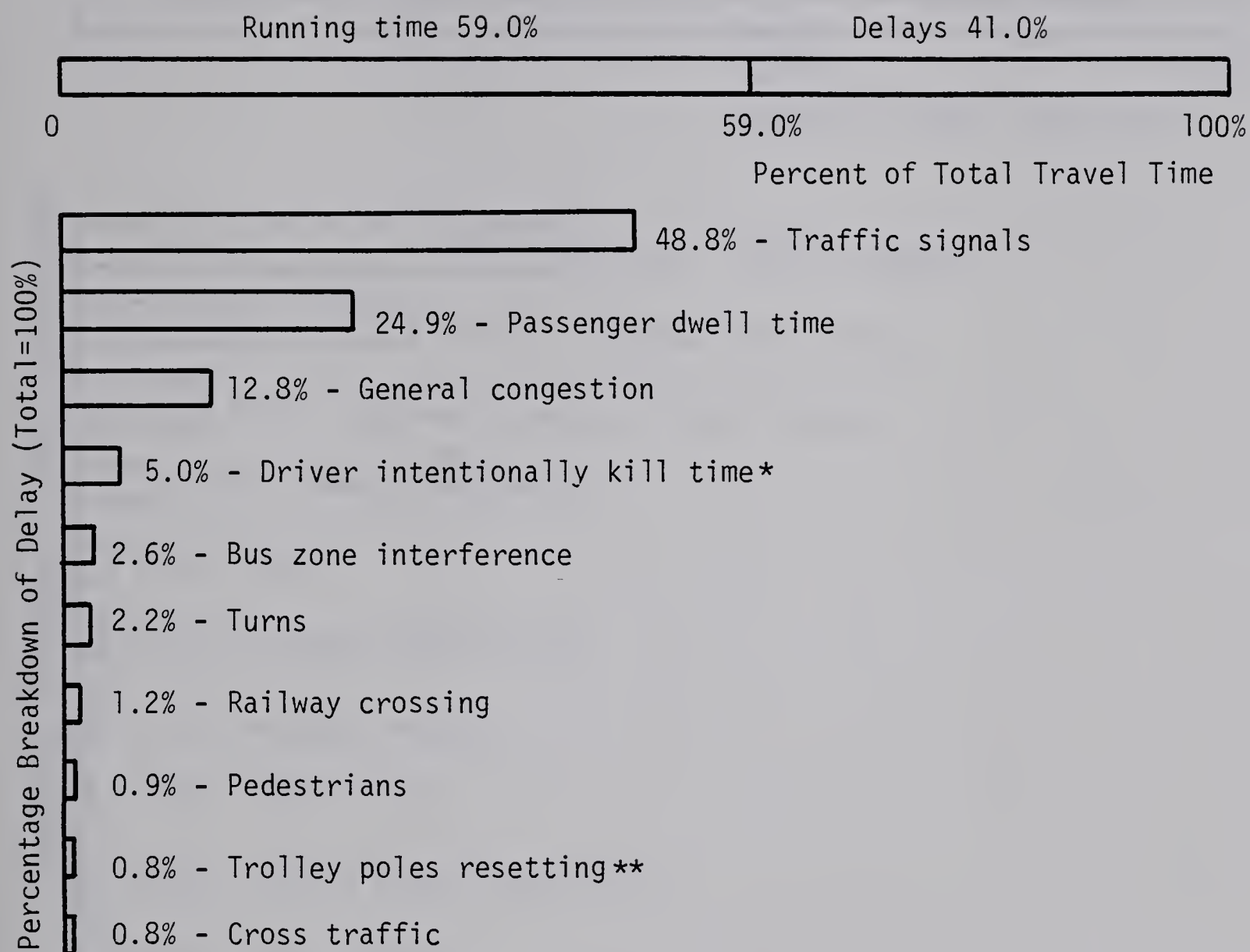
** 21 out of 42 Runs are Trolley Buses

Figure III.5 Summary of the Transit Delay on 107 Avenue from 101 Street to 124 Street (AM Peak)



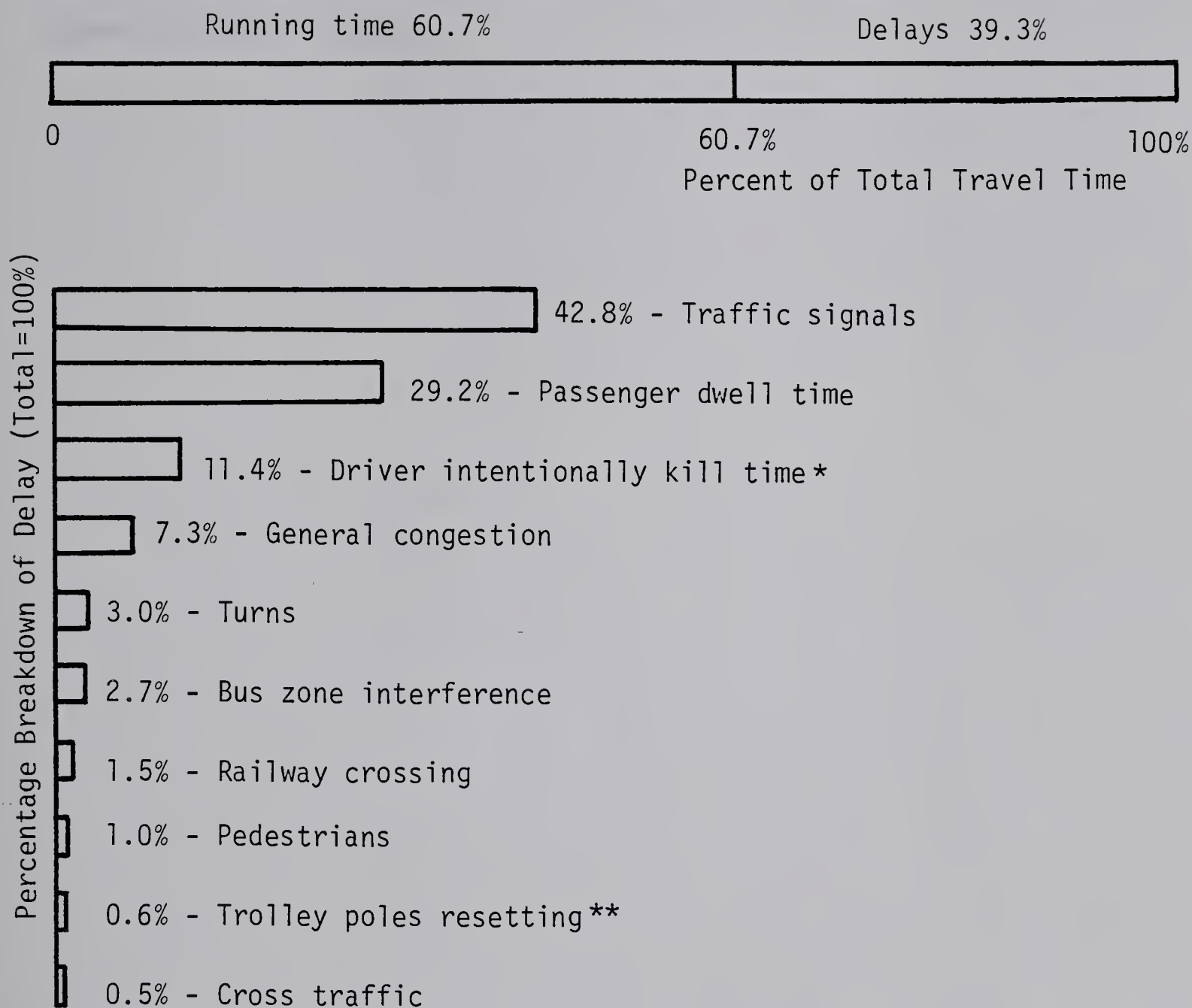
* Layover at Bus Stops

Figure III.6 Summary of the Transit Delay on 107 Avenue from 101 Street to 124 Street (Off Peak)



* Layover at Bus Stops
 ** 21 out of 42 Runs are Trolley Buses

Figure III.7 Summary of the Transit Delay on 107 Avenue from 101 Street to 124 Street (PM Peak)



* Layover at Bus Stops

** 43 out of 86 Runs are Trolley Buses

Figure III.8 Summary of the Transit Delay on 107 Avenue from 101 Street to 124 Street (AM and PM Peaks Combined)

The implementation of transit signal priority does not necessarily produce a drastic saving in time. However, the reliability of transit travel time will be improved and having a reliable schedule operation will enable the time-transfer system to function properly.

IV. THE *BUSPAS* COMPUTER SIMULATION MODEL

A. INTRODUCTION

It was first intended in this thesis that a transit corridor be simulated through a computer program and the benefits and/or disbenefits of various priority treatments be evaluated. A computer simulation program was brought to Edmonton through the courtesy of the Transport and Road Research Laboratory, England. This program, called BSPAS Priority ASSessment Simulation (*BUSPAS*), was developed from another simulation program named *ROSIM* (13). The following section gives a brief description of the model.

B. DESCRIPTION OF THE MODEL

BUSPAS is a microscopic traffic model in which individual vehicles are simulated. Each vehicle is represented by a block of computer words, and all the vehicles are dimensionally identical. An average vehicle length is specified in the program input data. This average length includes the length of the gap to the following vehicle in a static vehicle queue. The road network is represented by a set of discrete decision points, usually stoplines and detectors, joined by a one-way road link. Two-way roads are represented by a pair of one-way links. Vehicles enter and leave the network at fixed points and each vehicle is considered once in every simulated second. Each program cycle represents one simulated second. *BUSPAS* uses a binomial distribution of vehicle arrival. The model transfers vehicles between two decision points at a speed which is randomly selected from a distribution about the mean speed for that link. Turning movements at intersections are determined from pre-stored turning probabilities at each intersection, using a random number routine. A vehicle may be delayed before a stopline by red lights, may join a queue of vehicles discharging from the stopline, or may be impeded by a turning vehicle waiting for a gap in the opposing flow. The model outputs the number of vehicles that

13 R.G. Needham, "*ROSIM* : A Simulation Program of a Road Network Controlled by Traffic Responsive Signals", Paper presented at 1st Symposium Internationale sur la regulation du traffic, Versailles, June 1970.

have crossed each stopline, plus the total delay and average journey time through the link.

ROSIM includes a facility to select certain vehicles and follow them through the network. These special vehicles have been used in *BUSPAS* to represent buses. Special detectors simulate selective bus detectors and the particular priority strategy given to buses at traffic signals can be specified by the user. *BUSPAS* is based on vehicle-actuated traffic signals but can simulate fixed time signals. A summary of the operation of the traffic signals may also be printed if required.

C. MEMORANDUM

The *BUSPAS* program was received in magnetic-tape form on July 9, 1979. It was then mounted and compiled on the university's computer system. At the same time, a simple schematic network was set up for a trial run. This is illustrated in Figure IV.1. A listing of the input data for this network is shown in Figure IV.2. After the initial trial run, it was found that there were some undefined variables and language problems within the program. Some of these variables were local system subroutines which were not available in the university's computer system, and others were program subroutines that were simply missing.

The problems encountered were brought to the attention of the Transport and Road Research Laboratory through correspondence. Some necessary information and updated routines were received and added to the program during the months of August and September, 1979. However, it was still unable to give decent output, a copy of which is in Appendix II. In Appendix III is output from the ICL computer at the Transport and Road Research Laboratory. Because of the large size of the program, it was difficult to locate all the errors. Furthermore, due to the limitation of time, work had finally to come to a halt.

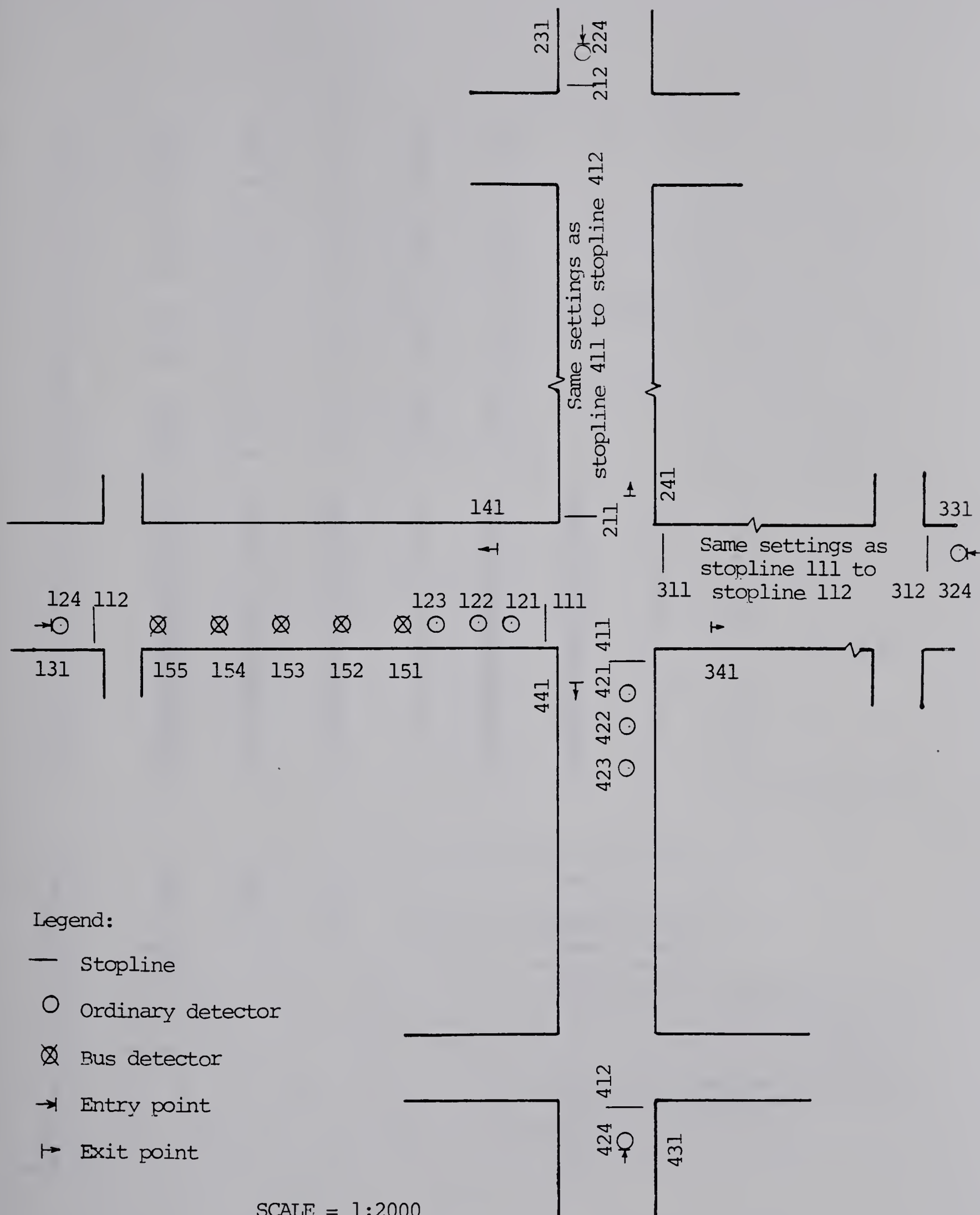


Figure IV.1 Location of Decision Points in a Network

END OF FILE

Figure IV.2 An Example of the Input Data for *BUSPAS*

A listing of the modified *BUSPAS* is enclosed in Appendix IV. The notes on the input data are presented in Appendix V. The modifications made to the program were as follows:

- 1) In the definition of variables, the 2-byte integer fields were inadequate and caused an error message in return. As a result, all integer declarations had to be changed to 4 bytes.
- 2) Some subroutines had inconsistent COMMON declarations as compared with the main program, and these were rectified.
- 3) The routines RAND1 and RANDI were substituted by the random number generator routine GGUBFS in the university's local IMSL library.
- 4) The routine FINISH, which is called in the subroutine ENDJOB (line 3502), was replaced by the routine EXIT that is available from the university's system subroutine library.
- 5) The logical system functions JAND, JINOR, and JEXOR were substituted by LAND, LOR, and LXOR respectively.
- 6) It was learned from the documentation provided that the subroutine STXIT, which is called in line 68 of the main program, is an assembler facility for stopping the job. However, this routine is called in the midst of the main program and it was felt that the information supplied may not be correct. It appears that the routine is irrelevant to the simulation results, thus it was suppressed by changing the line to a COMMENT statement.
- 7) The routine COMENT, which is a local routine to put a message in the job journal within the Transport and Road Research Laboratory computer system, and the routines CLOCK and CLOCK1, which both time the program, were restrained for the same reason.
- 8) In the subroutine READ, lines 2126 to 2140 had to be

concealed because they gave a series of undefined stopline printouts which were again irrelevant to the simulation results.

Since the *BUSPAS* program was not in its operative mode, the objective of testing various transit priority schemes through simulation could not be carried out in this thesis. The area of study was then changed to an investigation of the transit priority in areawide timing plan which is described in the following chapter.

The *BUSPAS* program was finally in operation at the time this thesis was written.

V. TRANSIT PRIORITY IN AREAWIDE TIMING PLAN

A. INTRODUCTION

In the conventional signal timing plan design, the criterion most used by traffic engineers is to minimize the vehicular delays and stops. A typical time-space diagram is illustrated in Figure V.1. On the average, buses accelerate and travel slower than private cars. When these characteristics are combined with the dwelling time incurred at bus stops, buses are often stopped by a red light at the next intersection. If the criterion of minimizing passenger delay is used instead, then the bus progression speed and time spent at bus stops should be taken into consideration. Figure V.2 shows the progression of buses after they are given attention. The offset at the downstream intersection is altered so that an approaching bus receives a green phase when it arrives. This may cause some delays to other traffic, but this is justified because of the large number of persons that buses carry when the total passenger delay of the intersection is taken into account. An application of this methodology in the off-line optimization technique, *TRANSYT*, is described in the following sections.

B. THE *TRANSYT* COMPUTER PROGRAM

TRANSYT, which stands for TRAFFIC NETWORK STUDY Tool (14), was developed at the Transport and Road Research Laboratory, England, in 1967. It is a method of modelling traffic behaviour through platoon dispersion in a roadway network. It includes a procedure that optimizes splits and offsets alternately by minimizing a performance index. The performance index is a linear combination of stops and delays that is specified by the user. *TRANSYT* makes the following assumptions about the traffic situation:

- 1) All the major intersections in the network have signals.
- 2) All the signals in the network have a known common cycle time or a cycle time of half this value.

14 D.I. Robertson, "*TRANSYT : A Traffic Network Study Tool*", *The Transport and Road Research Laboratory*, LR 253, 1969.

Legend:



Auto Progression



Bus Progression



Bus Stop

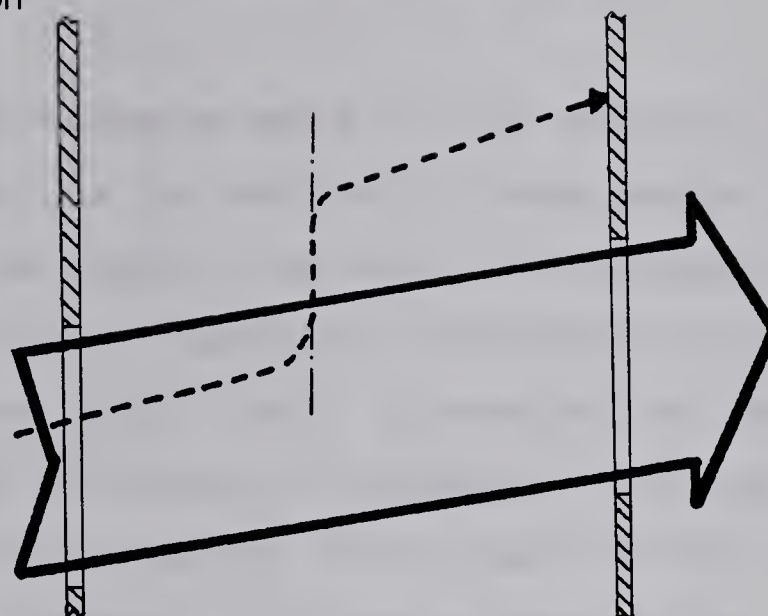


Figure V.1 A Time-space Diagram for the Auto and Bus Progressions

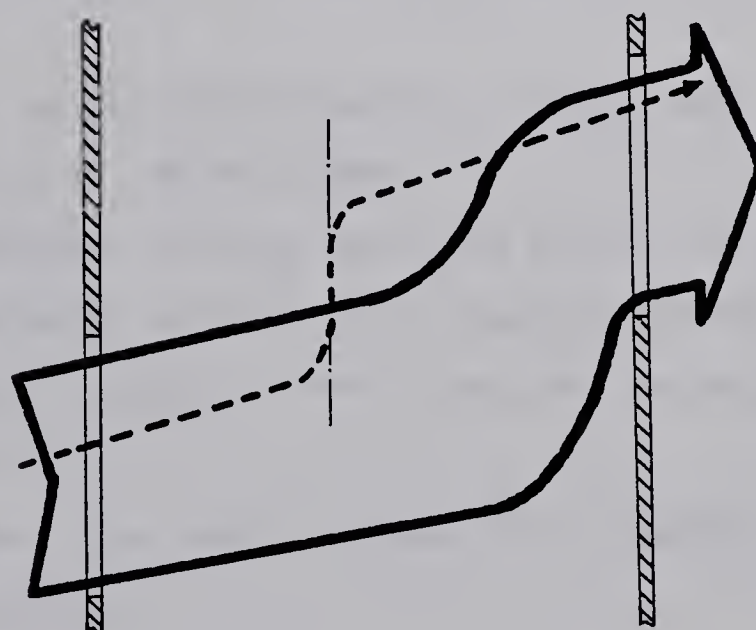


Figure V.2 Signal Modification to Favour the Bus Progression

- 3) Traffic enters the network at a constant, predetermined rate.
- 4) The proportion of traffic turning left or right at each signal remains constant throughout the cycle.

The optimization procedure begins with the calculation of the performance index of the network for an initial set of signal timings using the network traffic model. The next stage is to evoke an optimization routine, which is based on a "*pattern search technique*". The offset of one of the signals is altered by a certain "*step*", which is specified by the user, and the performance index of the network is recalculated. If the index is reduced, then the offset is altered successively in the same direction until a minimum performance index is obtained. If the index is increased, then the offset of the signal is altered in a direction opposite to that of the initial "*step*" until the minimum performance index is obtained. The offset of each signal in turn is adjusted in this way in a specified order. The process of optimizing the offset of each signal in turn is repeated a number of times to obtain the final signal settings. Phase splits may be held constant or may be optimized by introducing negative increments in the "*hillclimbing*" process.

The *TRANSYT* program prints out the following data:

- 1) A copy of the input data.
- 2) A tabulation of signal splits and offsets for each intersection.
- 3) A tabulation of traffic flow characteristics for each link.
- 4) Optional graphs of the arrival and discharge flow pattern on each link.
- 5) Optional time-space diagrams for a specified number of linked intersections.

A copy of the *TRANSYT* output is enclosed in Appendix VI. The summary of signal settings is expressed in terms of "*steps*". For the traffic flow characteristics of each link, the following information is provided:

- Link number

Bus links are marked with *.

- Total flow

This is expressed in vehicles per hour.

- Saturation flow

This is the maximum rate of discharge from a queue and can be obtained by measurement or calculation based on the physical site factors. Links having shared stoplines are identified by a letter 'L' or 'S' after a number in the saturation flow column. The 'L' indicates that the preceding number is not a saturation flow but the number of the link it is sharing a stopline with. 'S' indicates that the link shares its stopline with other links, and the number preceding the 'S' is the saturation flow at the shared stopline. This is also expressed in vehicles per hour.

- Degree of saturation

This is expressed as a percentage and it is the ratio:

$$\frac{\text{Total flow} \times \text{Cycle time}}{\text{Saturation flow} \times \text{Effective green time}} \times 100$$

It shows the spare green time available and how near the link is to maximum capacity. A value of over 100 means the link is oversaturated and a queue will grow steadily as the flow condition prevails.

- Distance travelled

This is the product of total flow and the link length. It represents the vehicle demand in the network. This is expressed in vehicle kilometres per hour.

- Time spent

This is the average number of vehicles present on the link and is made up of the sum of the average number delayed (uniform and random) plus the average number travelling along the link.

The average number of travelling vehicles is obtained from the total flow multiplied by the link travel time and is assumed to be unaffected by the signal settings. This is expressed in vehicle hours per hour.

- Uniform delay

This is the average number of vehicles queueing on the link, assuming there is no random fluctuation in traffic behaviour from cycle to cycle. This is expressed in vehicle hours per hour.

- Random delay

This is a correction applied to account for the extra delay caused by random fluctuation in vehicle flow. It is a function of the degree of saturation of the link. The total average delay on a link is the sum of the random and uniform delay. When the degree of saturation exceeds 100, the random delay is modified to give the average extra delay which would result from the growth of the vehicle queueing over the time period requested for simulation. This is also expressed in vehicle hours per hour.

- Uniform stops

This is the average number of vehicles per second which have to stop at the stopline. Any finite delay is assumed to cause a stop, even though in practice the vehicle involved may have undergone only a small deceleration and acceleration. For this reason, the predicted stops value is an overestimate of actual stops unless optional input information is used with a realistic set of stop and delay equivalences. The value in brackets is the percentage of all vehicles which have to stop. No correction is made for random effects.

- Maximum uniform queue

This is the average value of the maximum number of queueing vehicles calculated to occur in the signal cycle. No correction is made for random effects and there is a 50 percent probability

of exceeding this maximum value. The average value of the maximum queue is a useful guide to the vehicle storage capacity required in a section of road. Unless the actual storage comfortably exceeds the maximum queue value, there will likely be difficulty with blocking back into the upstream intersection.

- Exit signal

This is the node number which controls the link exit.

- Green period

The two values are the start and end of the actual green time as specified in the input data. The correction to effective green time is obtained by adding the lags specified at input.

a. Representation of buses in *TRANSYT*

In the early version of *TRANSYT*, there is no distinction between different classes of vehicles, for there is only one platoon dispersion formula representing the traffic flow within a network. The platoon dispersion formula is given by:

$$q'(i+T) = F q(i) + (1-F) q'(i+T-1)$$

where

$q(i)$ is the flow in the i th time interval of the initial platoon.

$q'(i+T)$ is the flow in the $(i+T)$ th time interval of the predicted platoon.

T is 0.8 times the average travel time, t , in number of "steps".

F is the smoothing factor.

A number K in the range of 1 to 100 can be specified in the input data to modify the smoothing factor F as follows:

$$F = \frac{1}{1 + KT/100}$$

where

K is a value between 1 and 100, a negative value gives zero dispersion but a zero gives the default value of 50.

In 1972, *TRANSYT* version 5 was introduced at the Transport and Road Research Laboratory (15). It includes a facility for representing multiple links at a common stopline, plus consideration for variations in bus running speed and time spent at bus stops along a link. The basic principle is to separate the delay calculation for transit and private vehicles. Additional formulae are utilized to account for the bus stopping and non-stopping situation along a link. The smoothing factor used in the bus dispersion formula is given by:

$$F = \frac{1}{1 + 0.7b + 0.15r}$$

and the time displacement, T, of the bus flow entering along the road is given by:

$$T = 0.3b + 0.85r$$

The values of b and r are calculated from the following formulae:

If $b = 0$

$$r = \frac{3.6 d}{v}$$

If $b > 0$ and $d > 60$

$$r = 16 + \frac{3.6 (d-60)}{v}$$

15 D.I. Robertson, and R.A. Vincent, "Bus Priority in a Network of Fixed Time Signals", *The Transport and Road Research Laboratory*, LR 666, 1975.

If $b > 0$ and $d < 60$

$$r = \sqrt{4.27 d}$$

where

b is the average time, in seconds, spent stationary at a bus stop.

d is the length of road between intersections in meters.

r is the running time in seconds.

v is the average free running speed of the bus (km/h).

These formulae allow for acceleration and deceleration time losses caused by stopping at bus stops. Furthermore, different delay weightings can be applied to each class of vehicle. If transit priority is desired, transit vehicles can be assigned a delay weighting in the input data that is higher than the weighting for private cars. Then the optimization process attempts to find a fixed-time signal plan which gives buses some degree of priority over other traffic.

b. The effect of delay weighting to transit

In a study by Peirce and Wood (16) in England, the effects of varying the bus delay weighting were tested using a trial network of 24 intersections. Figure V.3 shows that when the bus delay weighting is increased, bus delays are reduced, while delays to other traffic are increased. It was estimated that:

- 1) approximately two-thirds of the bus benefit came from optimizing the offsets, and
- 2) the remaining one-thirds came from optimizing the green intervals.

In theory, choosing the transit weighting according to the relative occupancies of buses and other vehicles should give the least overall passenger delay in the network. However, it is not considered feasible to measure

16 J.R. Peirce and K. Wood, "*BUS TRANSYT - A User's Guide*", *The Transport and Road Research Laboratory*, SR 266, 1977.

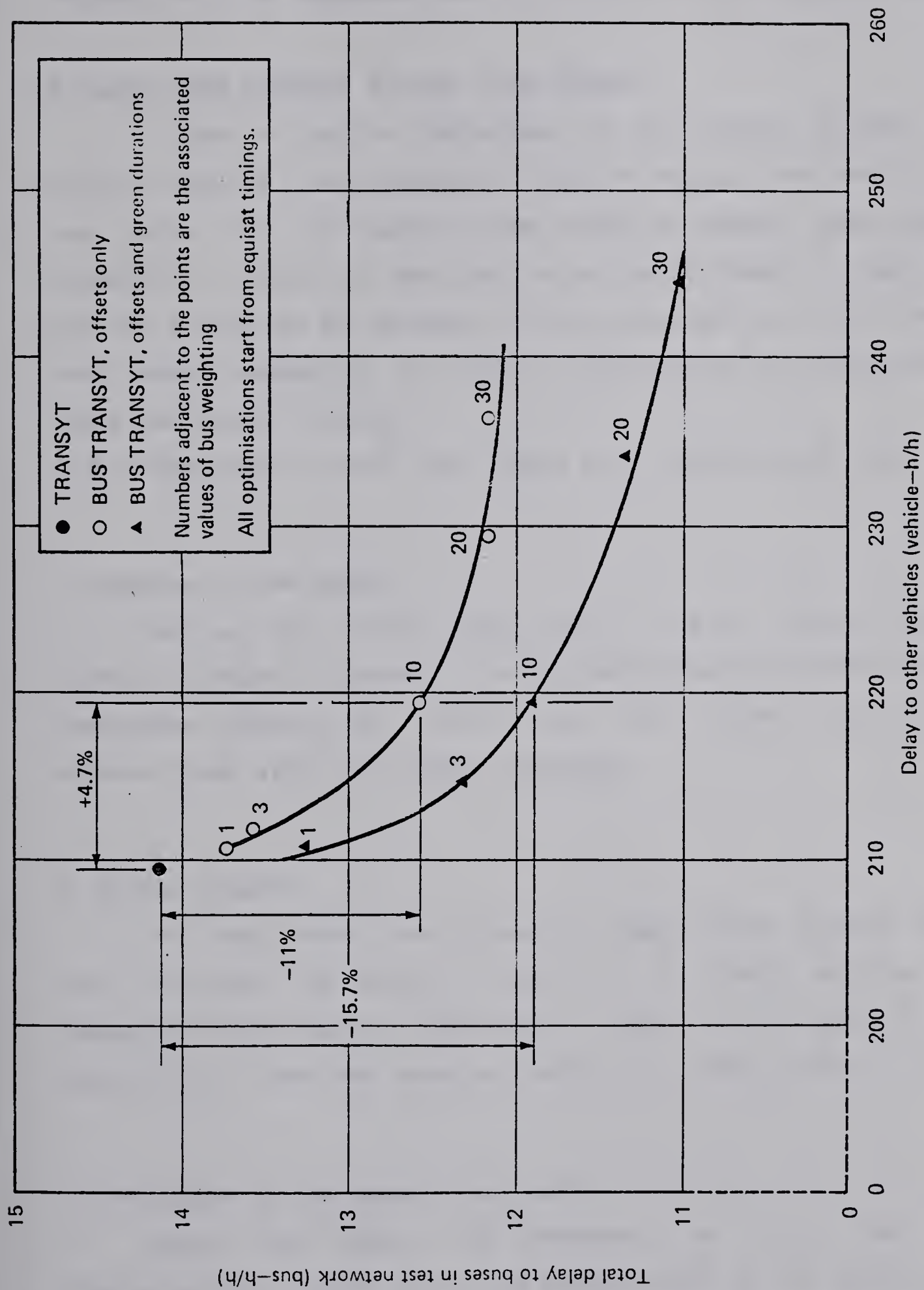


Figure V.3 The Effects of Different Bus Weightings and Optimising Techniques

Source: J.R. Peirce and K. Wood, "BUS TRANSYT - A User's Guide", The Transport and Road Research Laboratory, SR 266, 1977.

occupancies of every vehicle within the network. An approximation of the occupancies appears to be a logical approach. In Edmonton, a transit delay weighting of 20 is customarily used by the staff of the Engineering Department.

C. AUTO AND TRANSIT TRAVEL TIME SURVEY

In order to test the performance of the *TRANSYT* program with bus priority, a real-life "*before-and-after*" study for the auto and transit travel time was carried out. The "*before*" case utilized a standard signal timing plan optimized by *TRANSYT*, in which bus volume was combined with auto traffic. A bus was counted as the equivalent of three passenger car units. In the "*after*" case, special consideration was given to transit during the optimization of the timing plan through *TRANSYT*.

(N.B. In this study the term "*auto*" refers to all vehicles except transit vehicles.)

a. Objective of the survey

The main goal of the survey was to find out whether there was a significant increase or decrease in both transit and auto travel time and delay at intersections between the "*before*" and "*after*" cases. Both morning and afternoon peak traffic were under investigation.

b. Survey location

The study section was located on Jasper Avenue between 111 Street and 117 Street, as shown in Figure V.4. It consists of four signalized intersections and measures 734 meters in length. All the signals in the study section are of fixed-time mode and operate as a linked system.

c. Preparation of the signal timing plans

Before the survey was conducted, the timing plans for the "*before-and-after*" studies had to be prepared. Both of the signal timing plans used for the AM and PM peaks for the "*before*" case and the PM peak for

Legend:

Study Section



Figure V.4 A Map of the City of Edmonton

the "*after*" case were developed by the staff of the Engineering Department, City of Edmonton. The AM peak timing plan for the "*after*" case was prepared by the author. The output from the *TRANSYT* simulation is enclosed in Appendix VI. The following memoranda were made during the preparation of the AM peak timing plan:

- 1) The simulated network consisted of 13 signalized intersections from 108 Street to 121 Street along Jasper Avenue and 100 Avenue. Figure V.5 shows a plan of the network. This network was extracted from the entire CBD network because of its tremendous size. A trial run of this sub-network for the PM peak in the "*after*" case had been carried out to compare with the overall CBD network timing plan. It was found that in most cases the offsets and splits on Jasper Avenue in the sub-network plan agreed with the overall CBD network plan, with the worst within 2 seconds. These are demonstrated in Figures V.6 and V.7.
- 2) The cycle length used in the simulation was 86 seconds. This was determined at the "*constraint*" intersection at 109 Street and Jasper Avenue.
- 3) The inflow and saturation flow for each link were calculated using the intersection surveys prepared by the Engineering Department, City of Edmonton.
- 4) The eastbound auto traffic was assigned a delay weighting of 5. At first it was suspected that this assignment would probably cancel any benefits derived from the bus delay weighting. A second trial run was carried out without using any delay weighting for the auto traffic in the network. The output for this trial run is enclosed in Appendix VII. The stop penalty was the same for both cases. The bus performance index obtained was 16.06 as compared to 16.07 in the first case. This difference is insignificant but the offsets and splits do vary

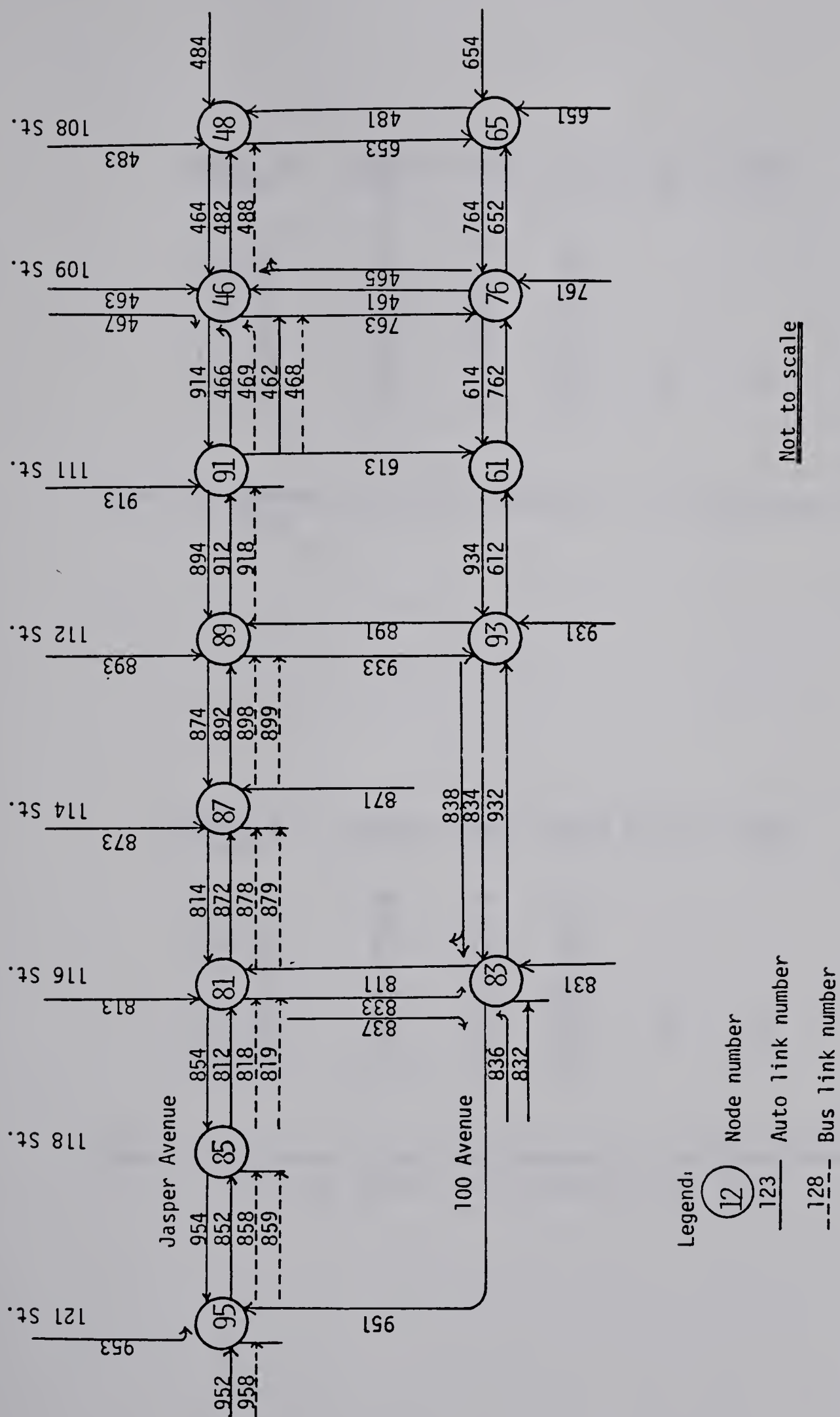


Figure V.5 A Plan of the Study Section

JASPER AV. AND	NODES NO.	STAGE 1	STAGE 2	STAGE 3	STAGE 4
121 St.	95	16	3		
118 St.	85	1	31		
116 St.	81	37	21		
114 St.	87	25	12		
112 St.	89	12	41		
111 St.	91	17	37	7	
109 St.	46	1	18	34	37
108 St.	48	41	28		

Figure V.6 Summary of the Final Settings of the Sub-network (PM Peak)

JASPER AV. AND	NODES NO.	STAGE 1	STAGE 2	STAGE 3	STAGE 4
121 St.	95	16	3		
118 St.	85	1	31		
116 St.	81	37	21		
114 St.	87	25	12		
112 St.	89	11	40		
111 St.	91	16	36	6	
109 St.	46	0	17	33	36
108 St.	48	40	27		

Figure V.7 Summary of the Final Settings for the Same Nodes Extract from the Overall CBD Timing Plan (PM Peak)

between the two plans. In spite of that, the first case was implemented as it was felt that eastbound auto traffic is crucial during the morning peak.

- 5) Two bus links were simulated for the eastbound movement on Jasper Avenue, one for regular buses and the other for express buses. Another trial was executed, this one simulating only one bus link with bus stops. The output is presented in Appendix VIII. The delay weighting assigned to transit was 20 in both cases. The results were compared and it was found that there was no difference between the two sets of signal offsets and splits. This was probably due to the low number of express buses present (only fourteen for the non-stopping bus link). This demonstrates that the program is insensitive to small input volume. Thus, from an operational point of view, it is not worth while spending extra time simulating two separate bus links for one when the express bus-to-auto ratio is equal to or less than 1:93.

(N.B. It was felt that the indicator "*bus-to-auto ratio*" was more appropriate than just considering the bus volume alone. In this particular case, there were 14 express buses and an average auto volume of 1300 vehicles per hour in a eastbound direction. Thus the express bus-to-auto ratio calculated was 1:93.)

- 6) No special provision was made for either the auto or bus movement in a westbound direction.

d. Survey personnel

The data collection was carried out by two teams, with two persons in each team. The first team was responsible for the auto travel time study, in which one person drove the car and the other person recorded the data. The second team was responsible for transit travel time. Each person rode the bus separately and recorded his own data.

e. Survey methodology

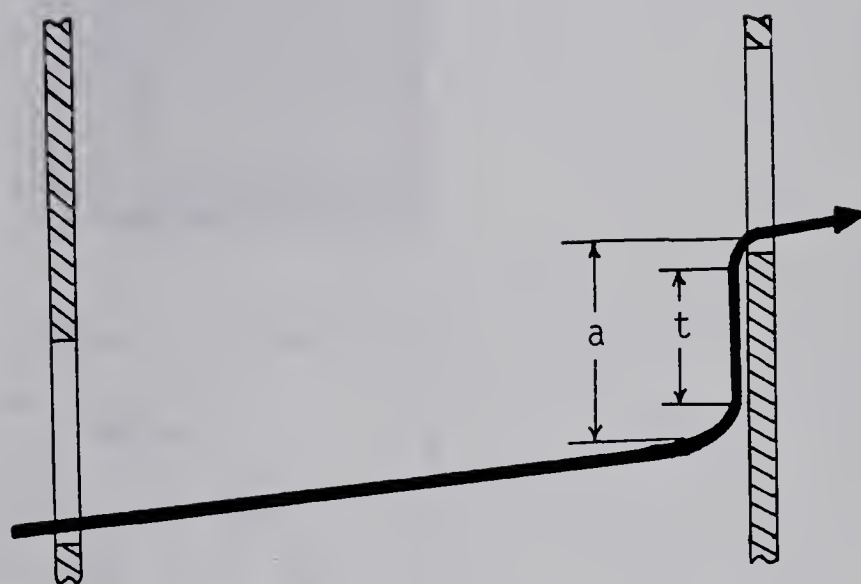
The observer for the transit survey occupied a seat in the front of the bus in order to view traffic conditions clearly. As the test run began, he started a stop-watch with a split-hand on it. Whenever the bus began to slow down for a red light at an intersection, he would press the split-hand button. By doing so, he was able to take the reading from the split without stopping the clock internally. Then the observer reset the split-hand after he had recorded the time. When the bus crossed the stopline on a green interval, he would press the split-hand button and repeat the same procedure. The difference between the two recorded times was the *true* delay encountered at an intersection. This process is referred to as the approach delay method, as illustrated in Figure V.8. The dwelling time of the bus was taken from the time it came to a complete halt at a bus stop until it started moving again. Other delays encountered along the route (for instance, at a pedestrian crossing or where a car was parked within the bus stop zone), were measured similarly. The stop-watch was stopped at the end of the study section and the overall travel time recorded.

The auto survey was similar to that of the bus, except the passenger boarding and alighting time was excluded. The test vehicle was driven along the study route using the floating-car technique; that is, the vehicle was driven according to the driver's judgement of the average speed of the traffic stream.

D. INTERPRETATION OF THE RESULTS

The data for the AM "*before*" and PM "*after*" cases were collected on January 15 and 16, 1980, while the AM "*after*" and PM "*before*" data were collected on April 1 and 2, 1980. Past experience in Edmonton showed that seasonal traffic variations are predictable and stable (17). This is illustrated in Figure V.9. Thus, the data taken in the "*before*" and the "*after*" cases were comparable.

17 "A Transportation Management System for the City of Edmonton", Engineering Department, City of Edmonton, 1977, p.9.

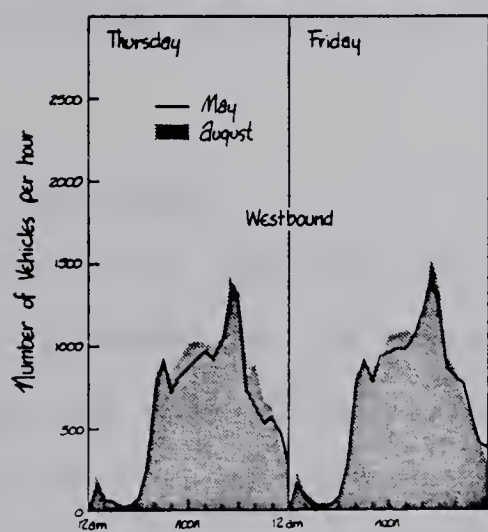
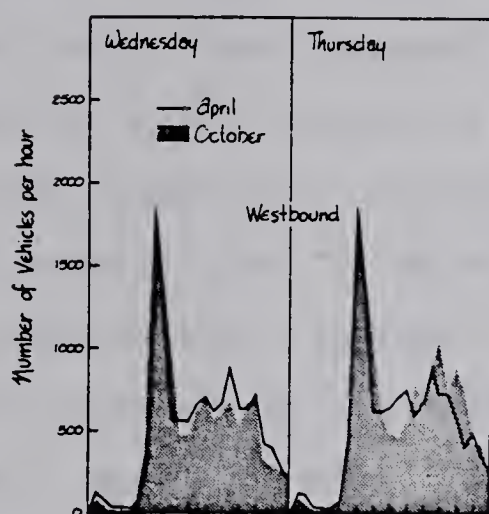
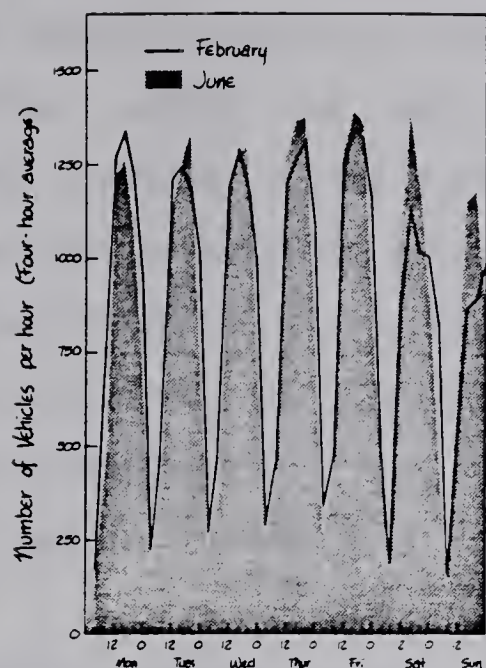


Legend:

- Auto Progression
 a = Approach Delay
 t = Stopped-time Delay

Figure V.8 A Time-space Diagram showing the Difference between the Approach Delay and Stopped-time Delay

Daily traffic variations at
Jasper Avenue East of
122nd Street



Hourly traffic variations at
James McDonald bridge,
St. Albert Trail and
63rd Avenue underpass

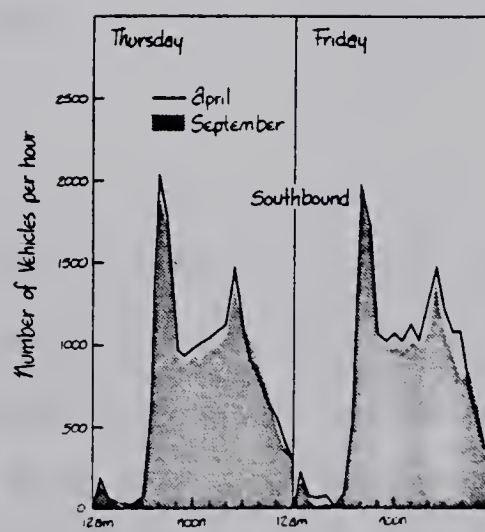


Figure V.9 Traffic Variations in Edmonton

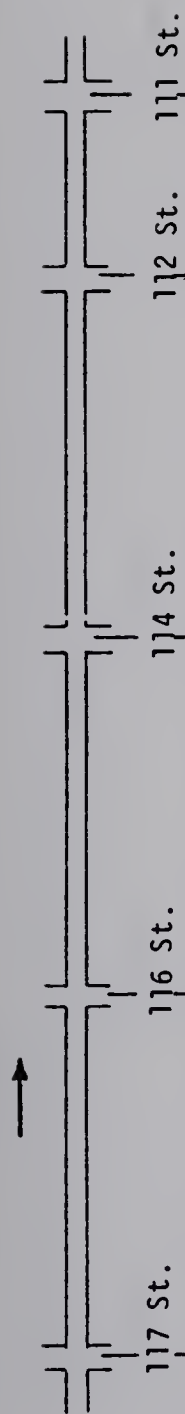
Source: "A Transportation Management System for the City of Edmonton",
Engineering Department, City of Edmonton, January 1977, p.9.

The recorded data were converted into speed and summarized in Tables V.1 to V.16. The minimum sample size requirements with 95 percent confidence level were checked utilizing the figures listed in the Manual of Traffic Engineering Studies, published by the Institute of Transportation Engineers (See Table V.17). Given that the permitted error in the estimate of mean travel speed for *"before-and-after"* studies is +2 km/h, the average range in the running speeds of the recorded data was calculated, as shown in Tables V.18 and V.19. The number of completed test runs met with the minimum sample size requirements as specified in Table V.17.

The percentage changes in both operating and running speeds for the *"before-and-after"* studies were calculated and summarized in Tables V.20 and V.21. In all cases, the figures indicate that there were improvements in both the operating and running speeds after the implementation of the new signal timing plan. In terms of statistics, some of these improvements were not significant at a 95 percent confidence level. Appendix IX contains the significance testing of the operating and running speeds, and Appendix X is the significance testing of the total average approach delay. Following are the analyses of the *"before-and-after"* studies on a directional basis.

a. AM eastbound movement

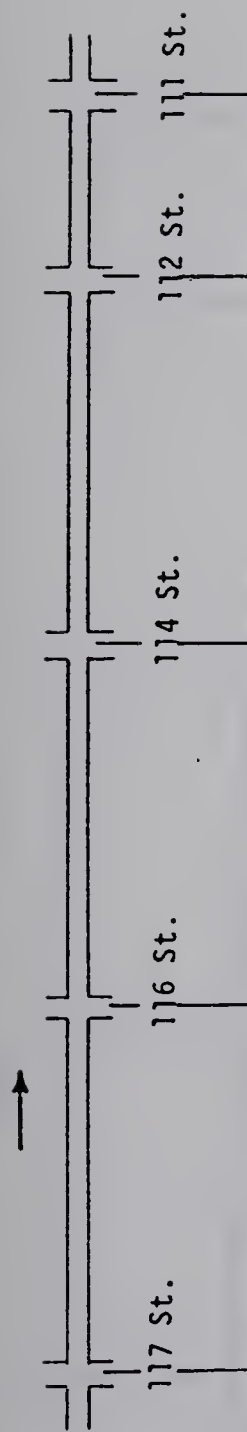
During the morning peak this was the direction in which buses were given favourable progression in the simulation. From the analysis of the field data, it was found that auto traffic significantly improved in overall travel time, but not buses. In terms of approach delay, there was a significant reduction in bus delay at intersections, as shown in Table V.22. This was also supported by the reduced percentage of buses stopping at intersections, as illustrated in Figure V.10. In other words, the new timing plan gave some degree of improvement to transit but not enough to affect the overall travel time significantly. The bus dwelling time for the *"before-and-after"* studies remained more or less the same, as exhibited in Table V.24.



Run No.	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Running speed (km/h)
1	0	34	0	0	29.23
2	32	0	38	0	25.22
3	38	0	57	51	26.56
4	0	26	0	0	31.79
5	0	34	0	50	25.93
6	0	35	0	0	29.76
7	35	0	0	46	32.14
8	16	0	44	49	32.17
9	6	18	0	50	30.99
10	34	0	6	46	32.71
11	0	0	0	0	28.41
12	34	0	15	32	29.42
Average	16.3	12.3	13.3	27.0	29.53
Std. dev.	16.9	15.8	20.8	24.3	2.57

AM EASTBOUND AUTO
 "BEFORE" - January 15 & 16, 1980
 Time: 07:30 - 08:30
 Condition: Fair

Table V 1 Summary of Auto Speed and Delay Study (AM Peak Eastbound "Before" Case)



Run No.	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1	32	0	7	28	21.84	47.06
2	41	0	0	0	20.17	30.39
3	0	0	25	43	19.87	38.22
4	42	0	0	0	20.02	31.52
5	0	0	0	0	33.88	34.85
6	28	0	14	0	25.17	38.17
7	33	0	26	13	21.31	39.35
8	36	0	23	0	22.21	39.63
9	0	0	0	0	33.45	37.49
10	20	0	21	0	25.91	38.30
11	11	0	29	0	26.16	33.86
12	0	0	0	0	38.30	38.91
Average	20.3	0	12.1	7.0	25.69	37.31
Std. dev.	17.2	0	12.1	14.2	6.25	4.36

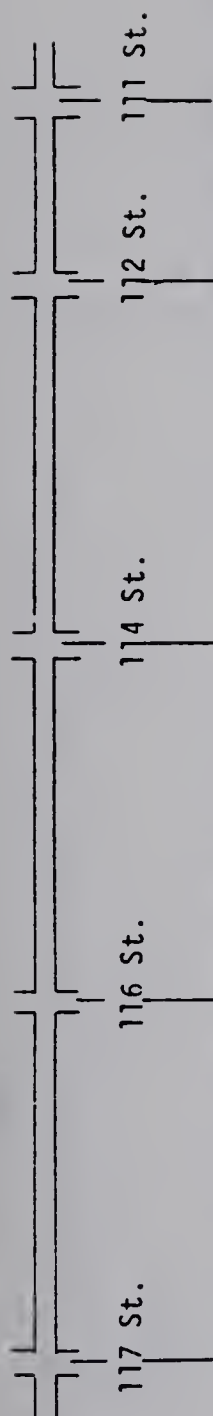
AM EASTBOUND AUTO

"AFTER" - April 1 & 2, 1980

Time: 07:30 - 08:30

Condition: Good

Table V.2 Summary of Auto Speed and Delay Study (AM Peak Eastbound "After" Case)



Run No.	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1	25	12	31	25	17	0	41	10.74	27.90
2	0	0	17	21	15	0	49	15.36	38.37
3	11	0	17	10	13	0	0	19.43	30.61
4	21	0	28	0	25	0	30	13.08	26.52
5	0	0	8	28	12	0	38	13.41	24.05
6	37	0	22	5	49	28	0	10.36	21.90
7	16	22	14	0	10	11	0	14.60	22.46
8	37	8	36	8	34	22	0	9.51	19.54
9	29	33	14	28	32	30	17	9.18	22.17
10	21	0	20	0	15	0	35	12.89	24.52
11	28	24	23	23	12	0	0	12.41	25.87
12	16	24	11	0	10	0	0	13.15	24.32
13	36	0	61	0	51	0	0	9.93	22.75
14	44	25	34	19	29	27	0	9.05	19.99
15	11	0	11	15	11	0	43	14.93	32.41
Average	22.1	9.9	23.1	12.1	22.3	7.9	16.9	12.54	25.56
Std. dev.	13.4	12.2	13.6	11.1	13.8	12.2	19.9	2.86	5.05

AM EASTBOUND BUS

"BEFORE" - January 15 & 16, 1980

Time: 07:30 - 08:30

Condition: Fair

Table V.3 Summary of Bus Speed and Delay Study (AM Peak Eastbound "Before" Case)

117 St. 116 St. 114 St. 112 St. 111 St.

Run No.	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1	21	0	22	14	19	0	14.44	24.83
2	24	0	30	0	30	0	13.83	25.42
3	19	25	9	0	11	27	13.83	27.88
4	25	0	29	0	45	0	13.02	29.28
5	7	0	13	23	32	0	14.21	25.22
6	20	0	9	0	39	15	14.93	27.27
7	29	0	33	0	23	16	13.02	27.29
8	18	0	27	31	18	0	14.84	32.38
9	21	31	28	31	30	0	10.49	30.32
10	8	0	7	0	13	32	16.11	26.65
11	11	0	14	21	13	0	14.44	25.40
12	43	37	42	26	15	0	10.05	25.58
13	16	0	29	31	17	0	14.36	29.19
14	28	0	28	23	25	0	13.41	28.48
15	16	0	20	0	18	31	15.82	31.52
Average	20.4	6.2	22.7	13.3	23.2	6.3	13.79	27.78
Std. dev.	9.0	13.0	10.3	13.6	10.1	11.3	1.68	2.38

AM EASTBOUND BUS

"AFTER" - April 1 & 2, 1980

Time: 07:30 -08:30

Condition: Good

Table V.4 Summary of Bus Speed and Delay Study (AM Peak Eastbound "After" Case)

117 St.	116 St.	114 St.	112 St.	111 St.
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Run No.	N/A	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1		0	0	28	23.81	37.17
2		0	7	0	31.46	33.46
3		22	0	25	23.81	38.92
4		17	0	27	22.78	36.08
5		13	0	33	23.81	39.37
6		21	0	30	22.98	39.62
7		19	0	29	21.48	34.32
8		11	0	30	24.24	35.49
9		27	0	25	19.15	31.40
10		17	0	0	25.65	31.61
11		0	33	0	24.70	33.99
12		0	27	0	26.42	38.51
Average		12.3	5.6	18.9	24.19	35.83
Std. dev.		9.9	11.6	14.1	2.97	2.93

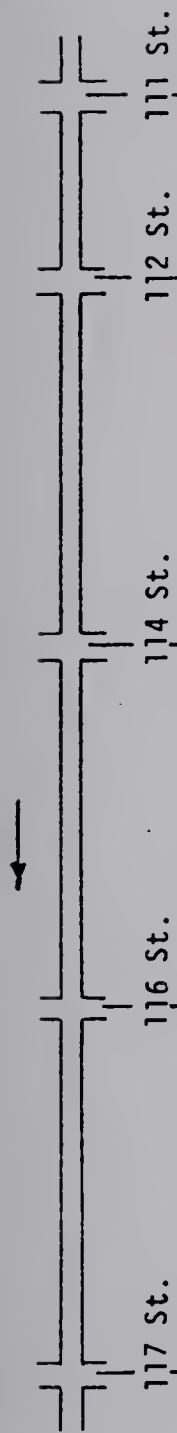
AM WESTBOUND AUTO
 "BEFORE" - January 15 & 16, 1980
 Time: 07:30 - 08:30
 Condition: Fair

Table V.5 Summary of Auto Speed and Delay Study (AM Peak Westbound "Before" Case)

Run No.	N/A	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1		0	19	0	30.73	39.31
2		0	16	0	33.03	41.47
3		28	19	0	21.66	32.55
4		0	17	0	31.46	38.28
5		40	23	0	21.31	40.62
6		0	23	0	32.62	43.93
7		0	18	0	32.62	44.17
8		40	16	0	22.98	39.18
9		0	22	0	31.09	40.18
10		32	0	0	26.69	38.45
11		32	14	0	22.58	34.33
12		0	19	0	30.73	39.31
Average		14.3	17.2	0	28.13	39.32
Std. dev.		18.0	6.1	0	4.72	3.36

AM WESTBOUND AUTO
 "AFTER" - April 1 & 2, 1980
 Time: 07:30 - 08:30
 Condition: Good

Table V.6 Summary of Auto Speed and Delay Study (AM Peak Westbound "After" Case)



Run No.	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1	0	20	12	0	9	0	19.15	26.88
2	16	19	10	0	15	0	16.83	26.31
3	15	20	12	0	9	0	17.16	26.69
4	12	0	12	0	33	0	17.05	27.35
5	6	30	0	0	9	0	17.98	25.33
6	8	26	0	0	17	0	17.50	25.44
7	7	0	0	0	11	34	14.52	22.56
8	10	18	12	0	9	0	17.98	25.97
9	7	19	5	0	8	0	17.50	22.37
10	9	37	10	22	12	32	11.49	24.46
11	9	19	9	0	12	0	17.98	26.42
12	14	27	12	0	8	0	15.92	23.51
13	11	20	10	0	7	0	16.52	22.88
14	6	24	6	0	9	0	18.48	25.89
Average	9.3	19.9	7.9	1.6	12.0	4.7	16.86	25.15
Std. dev.	4.2	10.0	4.8	5.9	6.7	12.0	1.92	1.69

AM WESTBOUND BUS
 "BEFORE" - January 15 & 16, 1980
 Time: 07:30 - 08:30
 Condition: Fair

Table V.7 Summary of Bus Speed and Delay Study (AM Peak Westbound "Before" Case)

Run No.	117 St.	116 St.	114 St.	112 St.	111 St.	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1						14	8	0	8	0	20.64	28.36
2						17	5	20	7	24	15.92	30.36
3						0	13	0	12	0	20.02	30.14
4						22	0	0	11	0	22.21	33.83
5						0	9	0	11	0	20.17	26.93
6						0	12	0	13	0	24.24	32.58
7						15	12	0	8	0	19.01	27.07
8						9	10	0	11	0	20.97	30.33
9						0	13	0	13	0	21.84	29.34
10						26	11	0	11	0	18.10	27.50
11						17	12	0	13	0	20.64	32.74
12						27	0	0	13	0	19.29	30.14
13						16	0	0	14	0	24.70	33.77
14						31	11	0	11	0	18.74	32.79
Average	6.9	13.9	8.3	1.7	11.1	1.7	11.1	1.7	1.7	1.7	20.46	30.42
Std. dev.	4.3	10.7	5.0	5.8	2.1	5.8	2.1	5.8	2.1	5.8	2.33	2.42

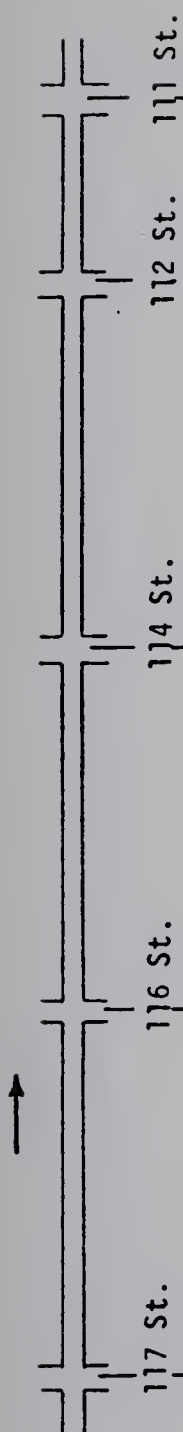
AM WESTBOUND BUS

"AFTER" - April 1 & 2, 1980

Time: 07:30 - 08:30

Condition: Good

Table V.8 Summary of Bus Speed and Delay Study (AM Peak Westbound "After" Case)



Run No.	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1	15	28	33	0	18.74	39.04
2	0	26	30	0	20.33	35.93
3	0	27	31	0	17.05	29.50
4	0	34	25	0	18.48	30.19
5	0	30	31	0	18.48	34.22
6	0	23	26	0	20.02	25.76
7	0	28	30	7	19.15	35.05
8	0	34	37	26	16.01	37.73
9	0	15	0	50	21.66	42.39
10	0	33	32	0	19.87	36.13
11	0	36	49	67	12.95	41.35
12	0	21	32	24	19.43	37.95
Average	1.3	27.9	29.7	14.5	18.51	35.44
Std. dev.	4.3	6.1	11.2	22.9	2.30	4.92

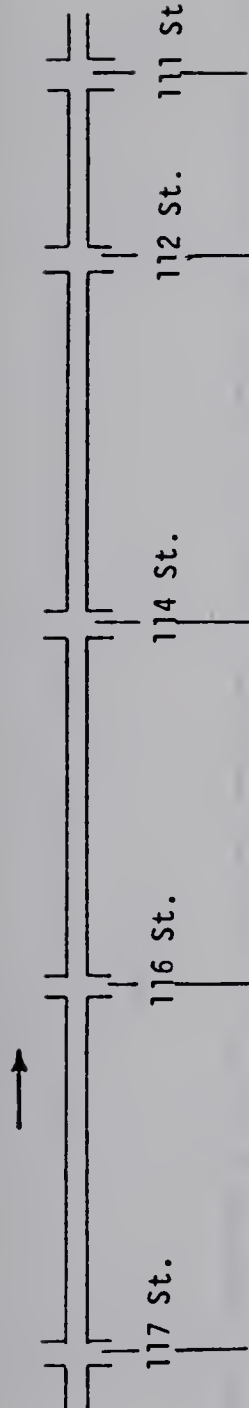
PM EASTBOUND AUTO

"BEFORE" - April 1 & 2, 1980

Time: 16:15 - 17:15

Condition: Good

Table V.9 Summary of Auto Speed and Delay Study (PM Peak Eastbound "Before" Case)



Run No.	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1	0	25	30	0	20.64	33.60
2	36	24	34	24	15.01	36.06
3	7	25	36	0	22.39	40.37
4	0	4	18	0	25.65	33.22
5	12	30	29	0	19.72	35.32
6	0	18	46	51	16.01	39.45
7	13	29	35	0	19.87	37.50
8	8	33	37	0	20.33	40.12
9	0	17	38	12	20.02	35.85
10	0	20	0	39	22.78	40.08
11	0	10	33	5	24.02	35.85
12	0	8	34	0	22.39	33.55
Average	6.3	20.3	30.8	10.9	20.74	36.75
Std. dev.	10.6	9.2	11.7	17.7	3.05	2.70

PM EASTBOUND AUTO

"AFTER" - January 15 & 16, 1980

Time: 16:15 - 17:15

Condition: Fair

Table V.10 Summary of Auto Speed and Delay Study (PM Peak Eastbound "After" Case)



117 St. 116 St. 114 St. 112 St. 111 St.

Run No.	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1	9	24	15	15	14	25	0	13.08	23.01
2	14	23	15	25	24	24	43	9.82	20.24
3	13	27	12	0	17	0	0	15.10	25.45
4	12	28	17	15	24	0	0	13.15	28.44
5	12	0	28	0	16	0	0	17.50	27.62
6	0	0	14	0	38	0	42	14.28	29.81
7	0	20	11	25	18	48	45	10.79	29.74
8	12	34	17	14	24	0	0	12.70	25.47
9	13	14	12	0	23	25	27	11.06	23.10
10	22	0	15	21	38	0	52	10.49	26.34
11	10	7	12	31	24	0	0	14.84	28.72
12	4	23	25	15	13	24	0	13.55	26.43
13	23	36	9	30	24	0	0	11.15	22.81
Average	11.1	18.2	15.5	14.7	22.8	11.2	16.1	12.89	25.94
Std. dev.	7.0	12.8	5.4	11.6	7.9	16.0	21.8	2.21	2.97

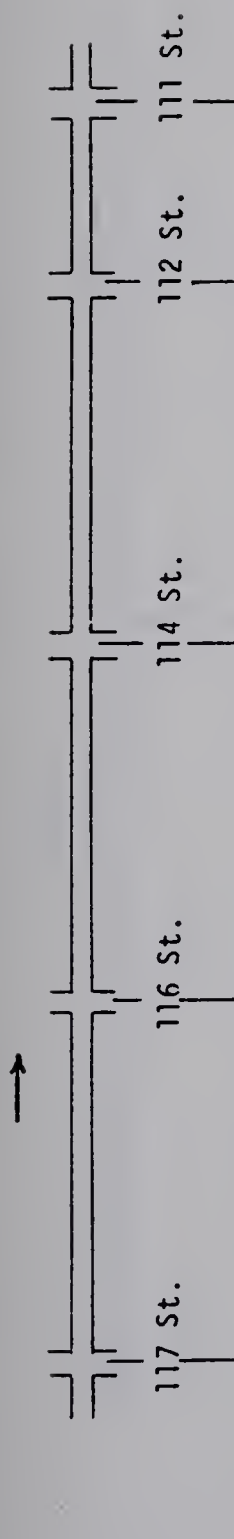
PM EASTBOUND BUS

"BEFORE" - April 1 & 2, 1980

Time: 16:15 - 17:15

Condition: Good

Table V.11 Summary of Bus Speed and Delay Study (PM Peak Eastbound "Before" Case)



Run No.	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1	0	10	30	0	53	11	45	9.24	22.70
2	15	0	12	22	14	25	0	13.98	24.63
3	14	27	11	29	14	5	0	14.28	26.95
4	15	10	9	19	14	26	0	14.93	25.47
5	20	15	18	0	51	49	0	10.40	34.18
6	0	0	23	0	24	0	52	15.27	38.52
7	18	30	32	0	43	0	44	10.96	34.69
8	23	0	12	0	25	0	44	13.02	29.06
9	0	0	22	0	28	0	35	16.52	37.23
10	11	33	10	20	7	19	0	14.60	27.58
11	16	26	10	11	11	26	0	14.44	27.23
12	10	0	18	0	28	0	43	13.15	25.06
13	14	0	13	0	16	0	0	22.02	34.56
Average	12.0	11.6	16.9	7.8	25.2	12.4	20.2	14.06	29.84
Std. dev.	7.6	13.1	7.8	10.9	15.2	15.5	23.0	3.17	5.29

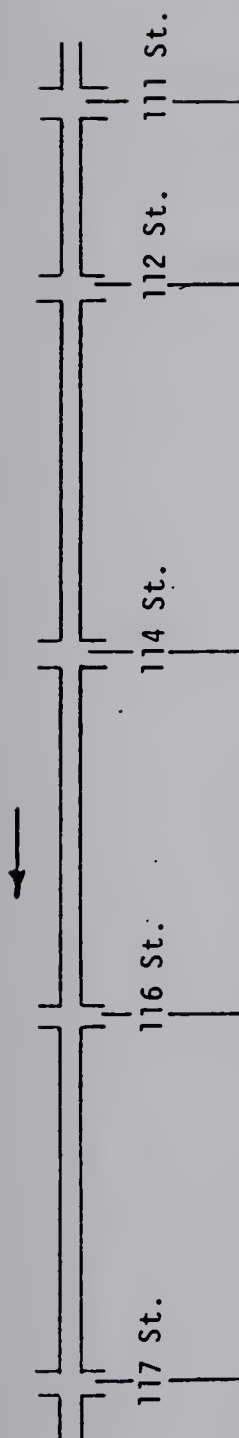
PM EASTBOUND BUS

"AFTER" - January 15 & 16, 1980

Time: 16:15 - 17:15

Condition: Fair

Table V.12 Summary of Bus Speed and Delay Study (PM Peak Eastbound "After" Case)



Run No.	N/A	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1		0	0	0	20.81	30.94
2		0	0	0	19.57	26.77
3		28	32	43	31.46	34.49
4		25	33	0	15.82	20.20
5		22	0	0	23.18	23.13
6		22	33	0	16.52	28.77
7		22	0	0	20.64	28.41
8		36	35	37	30.37	30.11
9		43	35	0	29.04	29.09
10		24	0	0	26.67	31.35
11		35	20	0	19.01	30.31
12		36	35	37	20.33	33.89
Average		24.4	18.6	9.8	22.79	28.96
Std. dev.		13.3	16.9	17.7	5.34	4.08

PM WESTBOUND AUTO
 "BEFORE" - April 15 & 16, 1980
 Time: 16:15 - 17:15
 Condition: Good

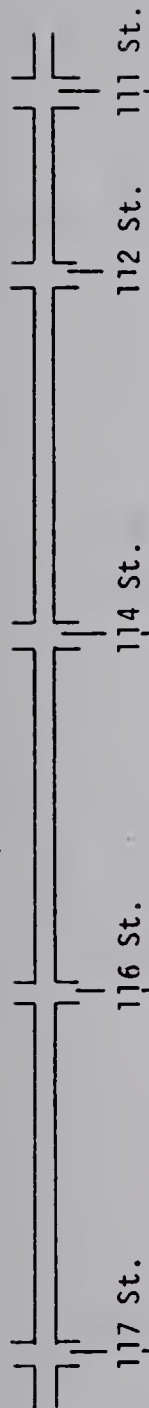
Table V.13 Summary of Auto Speed and Delay Study (PM Peak Westbound "Before" Case)

117 St.	116 St.	114 St.	112 St.	111 St.
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Run No.	N/A	Approach delay (sec.)	Approach delay (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1		29	19	12	29.04	29.77
2		29	0	0	35.23	37.84
3		0	0	0	17.16	38.97
4		0	34	0	19.01	31.54
5		0	0	0	32.62	41.07
6		34	36	0	19.01	34.46
7		0	32	0	30.37	37.45
8		0	0	0	16.01	30.95
9		0	0	0	14.52	32.23
10		0	0	0	27.53	32.93
11		41	0	0	17.16	35.46
12		37	0	0	16.01	30.95
Average		14.2	10.1	1.0	22.81	34.47
Std. dev.		17.8	15.4	3.5	7.52	3.67

PM WESTBOUND AUTO
 "AFTER" - January 15 & 16, 1980
 Time: 16:15 - 17:15
 Condition: Fair

Table V.14 Summary of Auto Speed and Delay Study (PM Peak Westbound
 "After" Case)



Run No.	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Dwelling time (sec.)	Approach delay (sec.)	Operating speed (km/h)	Running speed (km/h)
1	13	0	8	16	10	0	10.61	23.11
2	23	0	12	45	38	21	14.93	25.33
3	12	10	7	29	5	0	15.27	24.63
4	18	0	10	30	9	0	15.73	27.09
5	12	0	12	0	0	0	18.10	27.29
6	18	32	19	0	18	49	16.11	26.18
7	17	0	16	32	7	0	17.73	31.10
8	6	0	14	24	7	0	14.44	24.37
9	11	29	10	0	10	0	16.21	25.88
10	6	0	36	0	8	0	12.23	21.14
11	21	30	22	0	14	0	11.39	22.50
12	13	15	10	23	12	0	16.31	23.56
13	17	0	19	30	11	0	18.48	25.59
14	12	0	19	23	13	0	16.52	24.98
Average	14.2	8.3	15.3	18.0	11.6	5.0	15.29	25.20
Std. dev.	5.0	12.8	7.6	15.3	8.7	13.8	2.41	2.42

PM WESTBOUND BUS

"BEFORE" - April 1 & 2, 1980

Time: 16:15 - 17:15

Condition: Good

Table V.15 Summary of Bus Speed and Delay Study (PM Peak Westbound "Before" Case)

Run No.	117 St.	116 St.	114 St.	112 St.	111 St.	Running speed (km/h)
1	24	40	24	6	28	26.53
2	14	0	9	17	21	25.89
3	17	0	14	25	12	24.12
4	13	0	9	21	20	24.17
5	8	27	5	0	8	26.11
6	23	13	15	0	12	26.33
7	11	27	14	0	13	28.51
8	15	0	16	18	23	23.13
9	7	28	12	0	12	26.87
10	39	25	7	0	24	27.07
11	19	34	27	20	16	30.20
12	6	0	6	27	6	33.76
13	15	15	14	0	0	27.67
14	8	0	5	13	12	28.08
Average	15.6	14.9	12.6	10.5	14.8	27.03
Std. dev.	8.8	14.9	6.7	10.6	7.7	2.69

PM WESTBOUND BUS

"AFTER" - January 15 & 16, 1980

Time: 16:15 - 17:15

Condition: Fair

Table V.16 Summary of Bus Speed and Delay Study (PM Peak Westbound "After" Case)

Average Range in Running Speed (kph)	Minimum Number of Runs Specified Permitted Error				
	± 2.0 kph	± 3.5 kph	± 5.0 kph	± 6.5 kph	± 8.0 kph
5.0	4	3	2	2	2
10.0	8	4	3	3	2
15.0	14	7	5	3	3
20.0	21	9	6	5	4
25.0	28	13	8	6	5
30.0	38	16	10	7	6

Table V.17 Minimum Sample Size Requirements for Speed and Delay Studies with 95 percent Confidence Level

Source: "Manual of Traffic Engineering Studies", Institute of Transportation Engineers, Fourth Edition, 1976, p.165.

AM	AUTO		BUS	
	Before	After	Before	After
EASTBOUND	R = 2.8 N = 4 n = 12	R = 4.7 N = 4 n = 12	R = 3.9 N = 4 n = 15	R = 2.2 N = 4 n = 15
WESTBOUND	R = 3.0 N = 4 n = 12	R = 3.6 N = 4 n = 12	R = 1.9 N = 4 n = 14	R = 5.6 N = 4 n = 14

$$R = \frac{\sum S}{n - 1}$$

where R = Average range in running speed (km/h)

$\sum S$ = Sum of values for all running speed difference (km/h)

N = Number of required test runs estimated from Table V.17

n = Number of completed test runs

Table V.18 Comparison of the Number of Required and Completed Test Runs (AM Peak)

PM	AUTO		BUS	
	Before	After	Before	After
EASTBOUND	R = 4.9 N = 4 n = 12	R = 3.6 N = 4 n = 12	R = 4.4 N = 4 n = 13	R = 6.9 N = 6 n = 13
WESTBOUND	R = 6.5 N = 5 n = 12	R = 8.1 N = 6 n = 12	R = 4.1 N = 4 n = 14	R = 4.0 N = 4 n = 14

$$R = \frac{\sum S}{n - 1}$$

where R = Average range in running speed (km/h)
 $\sum S$ = Sum of values for all running speed difference (km/h)
 N = Number of required test runs estimated from Table V.17
 n = Number of completed test runs

Table V.19 Comparison of the Number of Required and Completed Test Runs (PM Peak)

AM	AUTO		BUS	
	Operating Speed	Running Speed	Operating Speed	Running Speed
EASTBOUND	+42.2% [*]	+26.4% [*]	+10.0% [#]	+ 8.7% [#]
WESTBOUND	+16.3% [*]	+ 9.7% [*]	+21.4% [*]	+21.0% [*]

* Significant at 95% confidence level

Not significant at 95% confidence level

Table V.20 Percentage Change in the Morning Peak Performance of the "Before-and-after" Studies

PM	AUTO		BUS	
	Operating Speed	Running Speed	Operating Speed	Running Speed
EASTBOUND	+12.0% [#]	+ 3.7% [#]	+ 9.1% [#]	+15.0% [*]
WESTBOUND	+ 0.1% [#]	+19.0% [*]	+ 0.7% [#]	+ 7.3% [#]

* Significant at 95% confidence level
Not significant at 95% confidence level

Table V.21 Percentage Change in the Afternoon Peak Performance of the "Before-and-after" Studies

AM	AUTO		BUS	
	Before	After	Before	After
EASTBOUND	n = 48 x = 17.2 s = 20.0	n = 48 x = 9.8 s = 14.4	n = 60 x = 11.7 s = 14.3	n = 60 x = 6.9 s = 12.0
	- 43.0% [*]		- 41.0% [*]	
WESTBOUND	n = 36 x = 12.3 s = 12.9	n = 36 x = 10.5 s = 13.1	n = 42 x = 8.7 s = 12.4	n = 42 x = 5.7 s = 9.6
	- 14.6% [#]		- 34.5% [#]	

* Significant at 95% confidence level

Not significant at 95% confidence level

Legend :

n = Number of samples

x = Average approach delay (sec.)

s = Sample standard deviation

Table V.22 Summary of the Total Average Approach Delay (AM Peak)

PM	AUTO		BUS	
	Before	After	Before	After
EASTBOUND	n = 48 x = 18.3 s = 17.3	n = 48 x = 17.1 s = 15.5	n = 52 x = 15.0 s = 15.8	n = 52 x = 13.0 s = 16.5
	- 6.6% [#]		- 13.3% [#]	
WESTBOUND	n = 36 x = 17.6 s = 16.8	n = 36 x = 8.4 s = 14.5	n = 42 x = 10.4 s = 14.8	n = 42 x = 8.5 s = 12.1
	- 52.3% [*]		- 18.3% [#]	

* Significant at 95% confidence level

Not significant at 95% confidence level

Legend :

n = Number of samples

x = Average approach delay (sec.)

s = Sample standard deviation

Table V.23 Summary of the Total Average Approach Delay (PM Peak)

AM	BUS DWELLING TIME	
	Before	After
EASTBOUND	n = 45 x = 22.5 s = 13.3	n = 45 x = 22.1 s = 9.7
	- 1.8% [#]	
WESTBOUND	n = 42 x = 9.7 s = 5.5	n = 42 x = 8.8 s = 4.3
	- 9.3% [#]	

Not significant at 95% confidence level

Legend :

n = Number of samples

x = Average dwelling time (sec.)

s = Sample standard deviation

Table V.24 Summary of the Bus Dwelling Time (AM Peak)

PM	BUS DWELLING TIME	
	Before	After
EASTBOUND	n = 39 x = 16.5 s = 8.3	n = 39 x = 18.1 s = 11.9
	+ 9.7% [#]	
WESTBOUND	n = 42 x = 13.7 s = 7.3	n = 42 x = 14.4 s = 7.7
	+ 5.1% [#]	

** Not significant at 95% confidence level

Legend :

n = Number of samples

x = Average dwelling time (sec.)

s = Sample standard deviation

Table V.25 Summary of the Bus Dwelling Time (PM Peak)

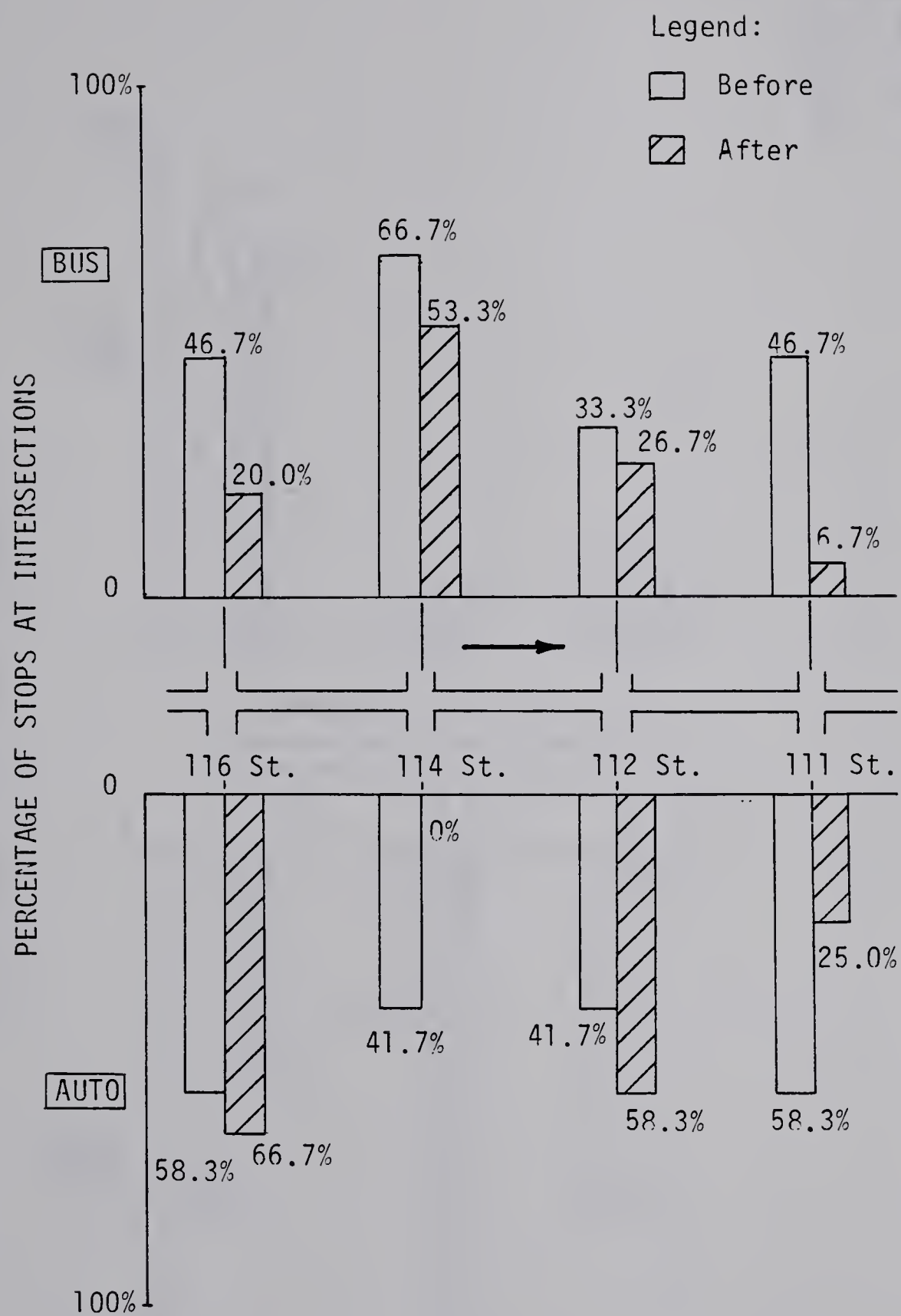


Figure V.10 Percentage of Stops at Intersections (AM Peak Eastbound)

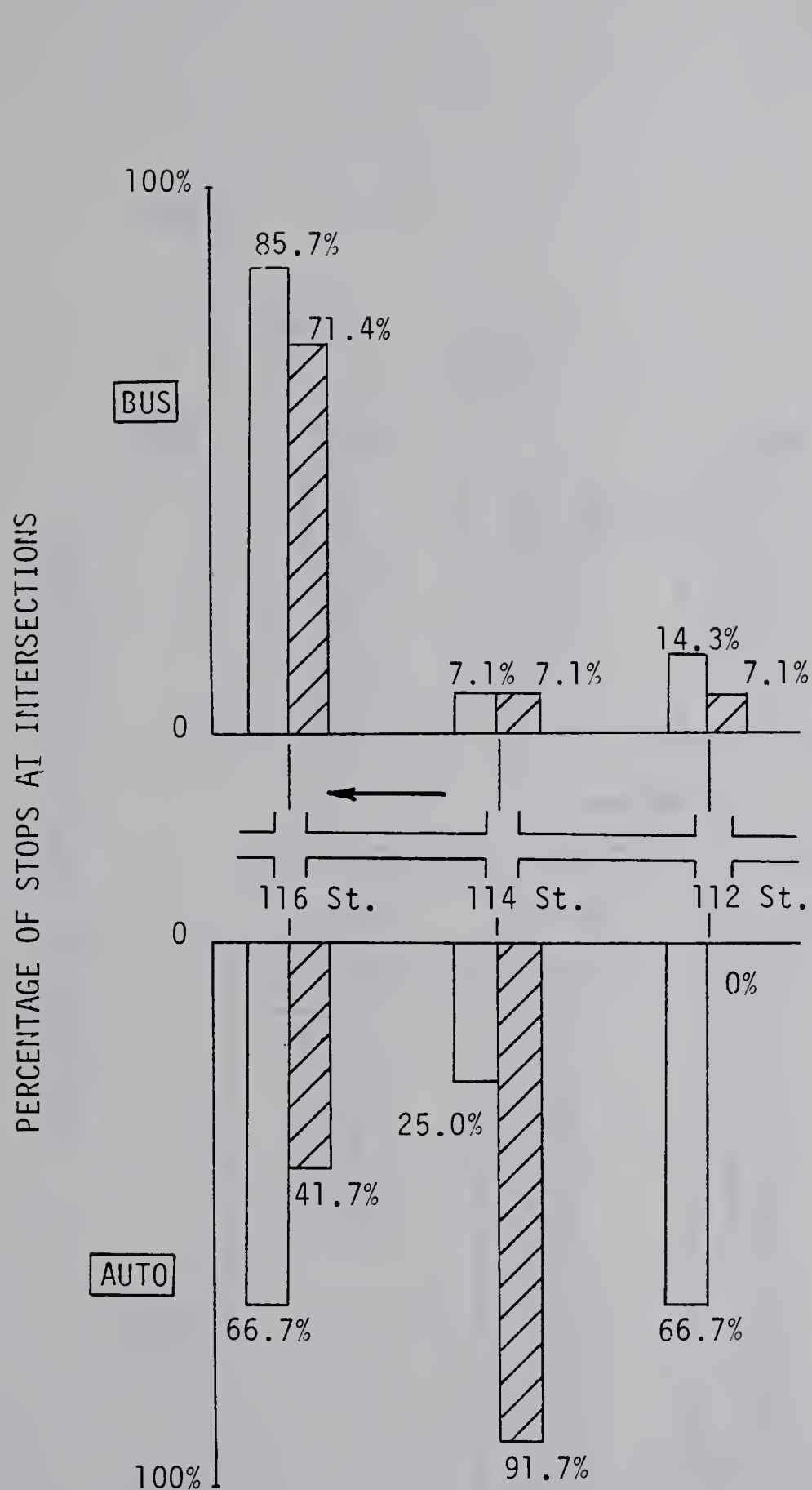


Figure V.11 Percentage of Stops at Intersections (AM Peak Westbound)

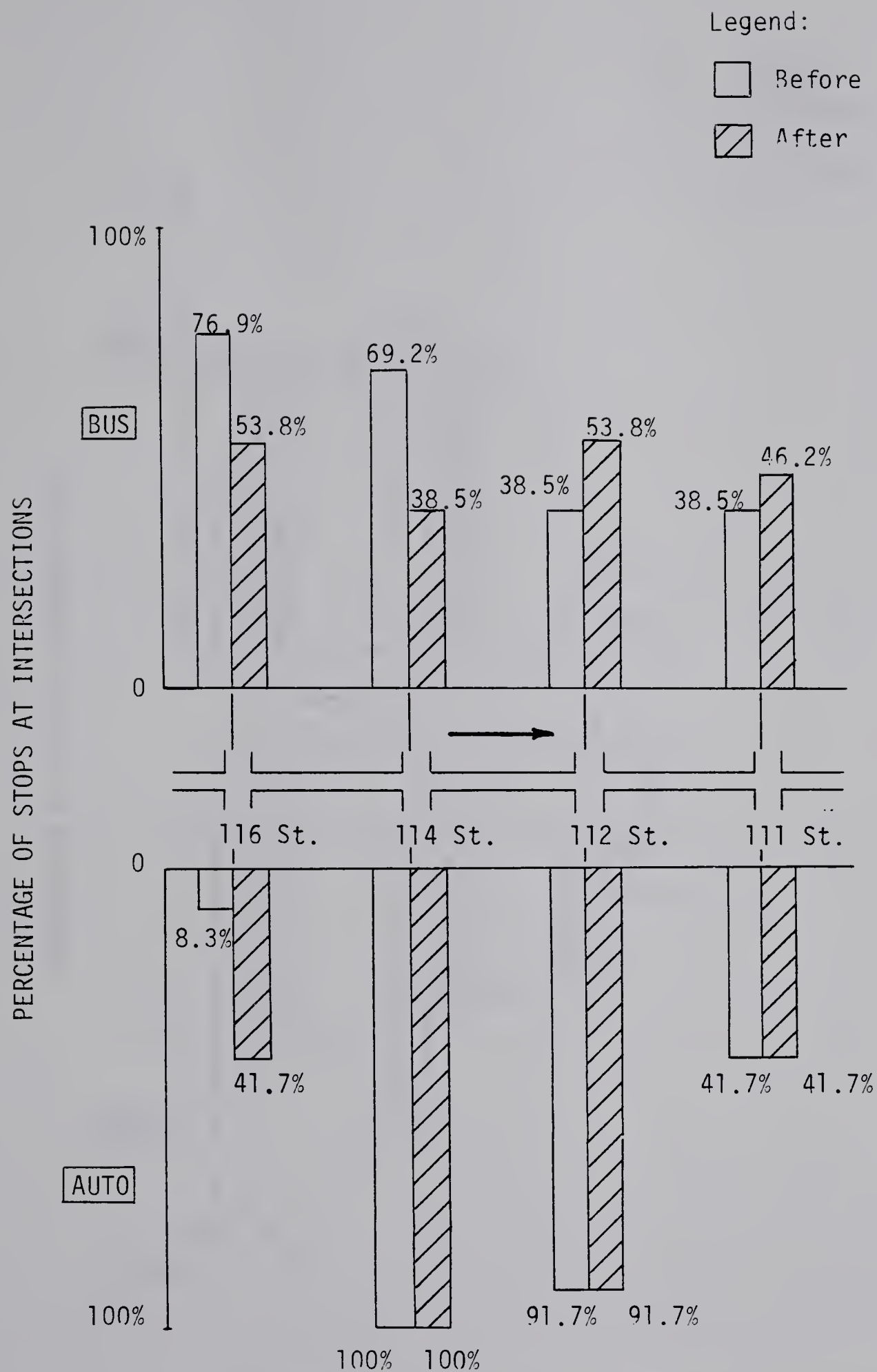


Figure V.12 Percentage of Stops at Intersections (PM Peak Eastbound)

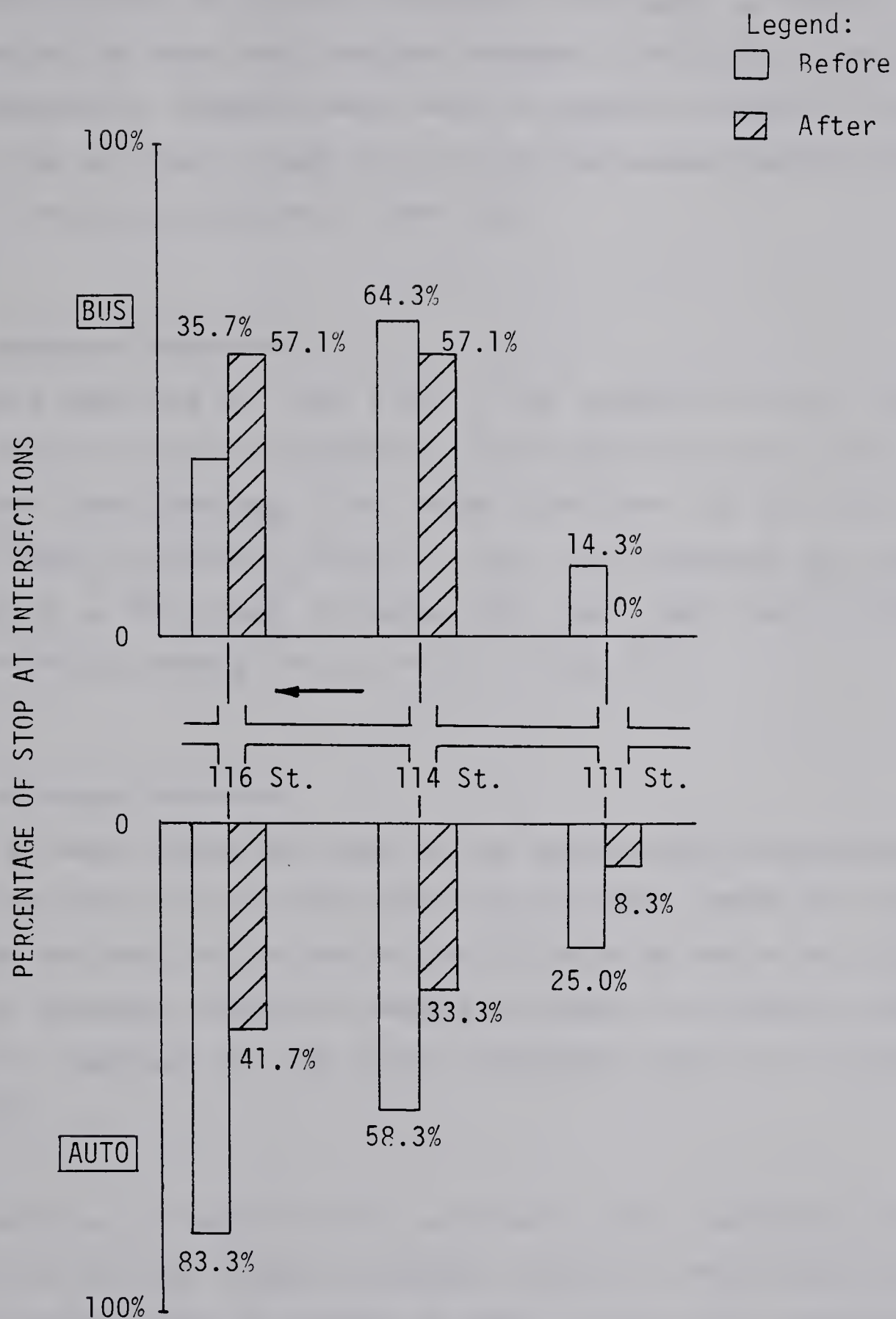


Figure V.13 Percentage of Stops at Intersections (PM Peak Westbound)

b. AM westbound movement

Although no special provision was made for auto or bus movement for this direction during the *TRANSYT* simulation, the results, as shown in Table V.20, indicate that there were significant increases in the overall travel time for both categories of vehicles. There were no significant changes in the bus dwelling time, as shown in Table V.24, and the total average approach delay for both auto and bus, as illustrated in Table V.22.

c. PM eastbound movement

Once again, bus and auto traffic in this direction were not given any special attention during the preparation of the signal timing plan. Even though there were some increases in the overall travel time and the total average approach delay, as shown in Tables V.21 and V.23 respectively, they were not significant at a 95 percent confidence level. Also, there was no significant change in the bus dwelling time, as shown in Table V.25.

d. PM westbound movement

The results indicate that buses did not gain any significant improvement in overall travel time and the total average approach delay. Tables V.21 and V.23 show that the buses did not have any priority at all, as they were expected to have. The passenger boarding and alighting time had a 5.1 percent increase but this is not significant at a 95 percent confidence level. This is illustrated in Table V.25.

As shown in Table V.21, the auto traffic had a insignificant increase in overall travel time. Yet it had a significant increase in running speed and total average approach delay, as exhibited in Tables V.21 and V.23 respectively. The latter finding is further supported by the reduced percentage of stops at intersections, as illustrated in Figure V.13.

A probable cause for this contradictory result was the inconsistencies of survey personnel. As mentioned before, the delay encountered at intersections was measured using the approach delay method. The exact time taken when the vehicle begins to slow down is purely up to the judgement of the person who records the data. The different survey personnel in the *"before-and-after"* studies may have caused this discordant finding.

Since the findings were discouraging and it was felt that a small survey should be conducted to investigate the performance of the *TRANSYT* program, a cyclic flow profile survey was carried out. It is described in the following sections.

E. CYCLIC FLOW PROFILE SURVEY

The output from *TRANSYT* includes an optional graphical representation of traffic behaviour at stoplines. This is called the cyclic flow profile, which represents the variation of flow during the signal cycle. The symbols ' $\uparrow$ ' and ' $\downarrow$ ' represent the flow up to the stopline, while ' $\rightarrow$ ' and ' $\leftarrow$ ' represent the flow leaving the stopline. The two flow patterns are overlaid so that the flow distortion caused by the red and green periods of the signal can be observed easily. Vehicular flows marked ' $\uparrow$ ' are stopped by the red light and leave at a later time at saturation rate as shown by the symbols ' $\rightarrow$ '.

The variation in the height of the cyclic flow profile corresponds to the movement of platoons of traffic along the street. The peaks and their locations within the graph give the time when the platoons will arrive at the downstream intersection, and they are important for good signal co-ordination. The cyclic flow profile can also provide information such as average flow, major and minor road flow, saturation flow, spare green time, traffic incidents, platoon speed and dispersion.

a. Objective of the survey

The main objective of this survey was to compare the actual cyclic flow profiles with the ones obtained from *TRANSYT* simulation, and to find whether or not there is a difference between the actual and the predicted flow patterns.

b. Survey methodology

The observer stood on the sidewalk at the downstream signal intersection. It was important that the observer chose a survey station beyond the maximum queue length of the downstream traffic. The distance between the survey station and the stopline was measured in order to transfer the cyclic flow profile histogram back to the stopline for later analysis. The observer started his survey when the upstream main road signal turned green, and recorded all cars, commercial vehicles and buses on the cassette-recorder as they passed his station. It should be stressed that the identification of the start of green in each cycle was a good practice for accuracy and convenience. Twenty-one successive cycles were recorded.

c. Comparison of the results

Due to the limitation of manpower and funds, data were collected at only 112 Street on Jasper Avenue for the AM eastbound movement and at 114 Street on Jasper Avenue for the PM westbound movement. These movements were chosen because buses were simulated separately in the *TRANSYT* program. The measured cyclic flow profiles for auto and buses can be compared separately with the predicted ones to reveal if there is any difference between theory and practice.

The cyclic flow profiles were plotted using 4-second intervals. The 95 percent confidence intervals of the actual flow profile were also plotted. The cyclic flow profiles from the *TRANSYT* output were then transferred onto these

figures for comparison.

i. AM peak movement

Judging from Figures V.14 to V.16, the actual flow profile during the morning peak comes very close to the predicted flow pattern for auto traffic. For the regular service buses, the same finding is true. As for the express buses, the predicted profile shows a continuous flow pattern allocated within a certain time interval, while the measured profile shows a discrete flow pattern within the same time interval. This can be explained by the fact that the *TRANSYT* program assumes a constant inflow rate at the entrance node of the network, whereas these express buses are governed by certain schedule headways. However, this is not too critical as the volume of the express buses is quite low when compared with the total traffic and will cause no significant change to the overall shape in the cyclic flow profile for superimposed bus and auto traffic.

ii. PM peak movement

During the afternoon peak, only one bus link was simulated for the "after" case by the staff of the Engineering Department, City of Edmonton. The predicted bus flow pattern, as shown in Figure V.17, appears to have a much lower flow rate than the measured one, which indicates that the input values for the buses were underestimated when running the program. In spite of that, the two general trends are very much alike.

As for the auto traffic, the predicted cyclic flow profile greatly differs from the measured profile, as shown in Figure V.18. This signifies a difference between theory and practice. However, the observation here in Edmonton comes as no surprise since the same findings are true in other cities. The first probable cause for this result was the crude assumption

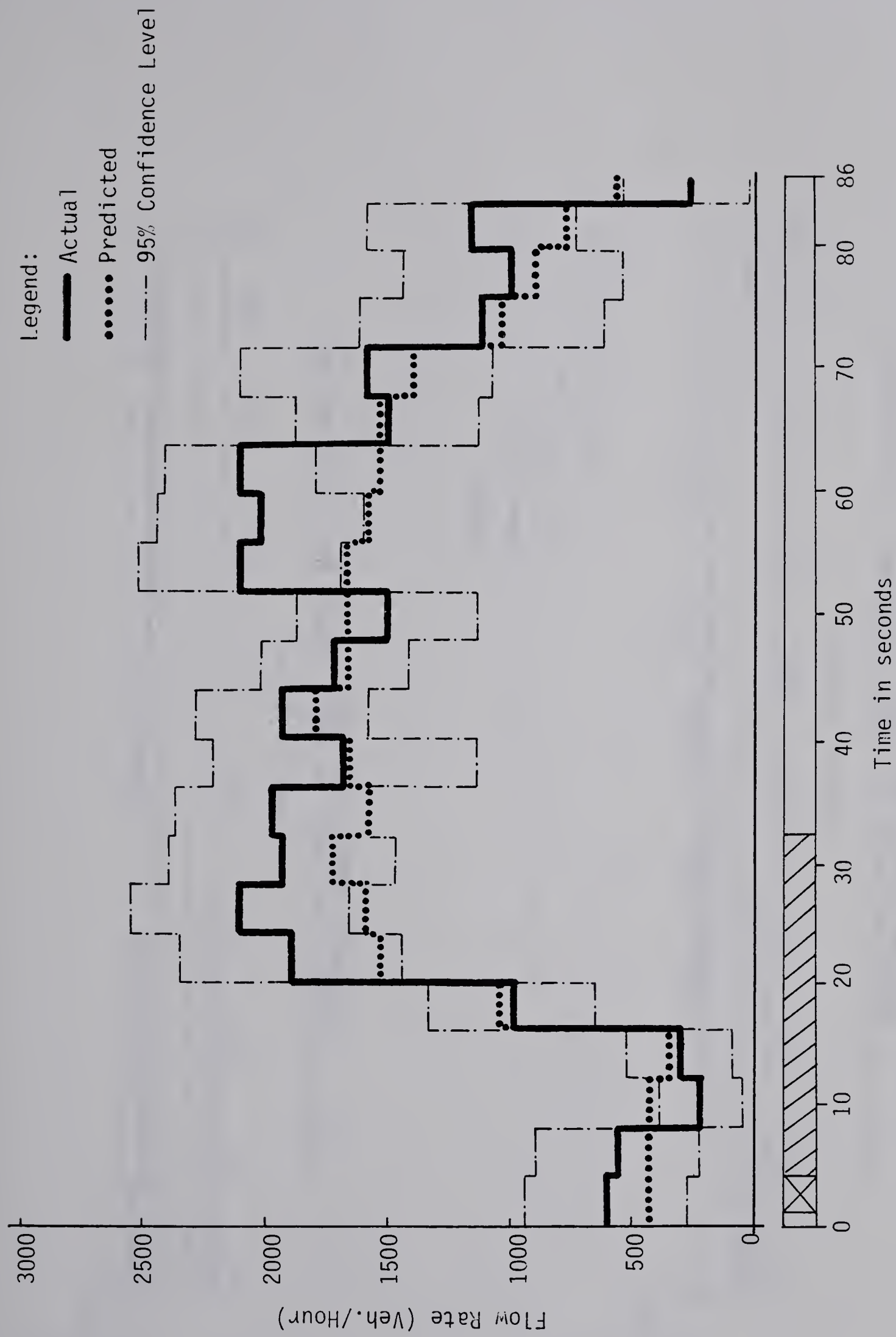


Figure V.14 Cyclic Flow Profile on Jasper Avenue and 112 Street (AM Eastbound Auto only)

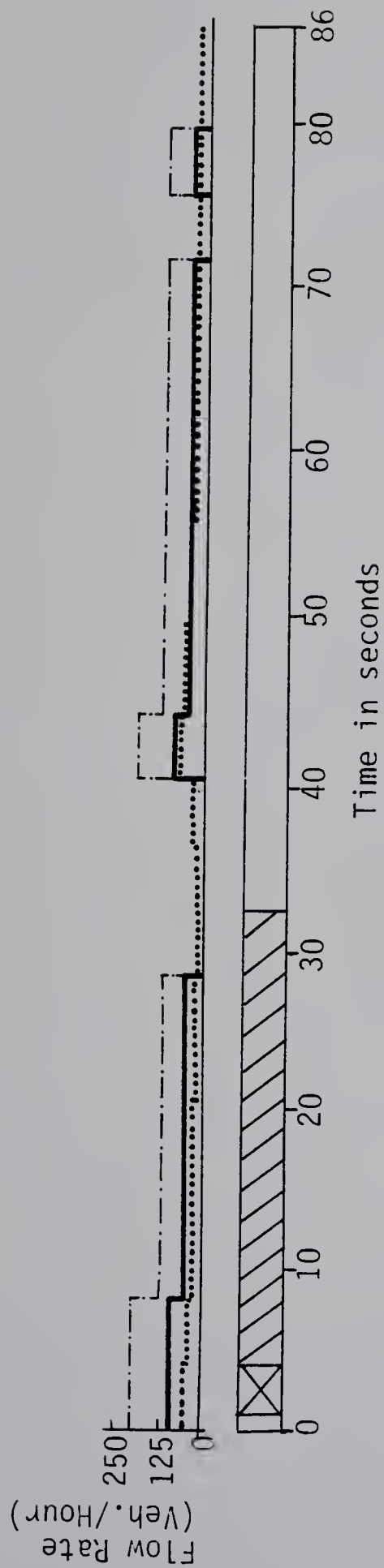


Figure V.15 Cyclic Flow Profile on Jasper Avenue and 112 Street (AM)
Eastbound Regular Bus only)

Legend:
 — Actual
 Predicted
 --- 95% Confidence Level

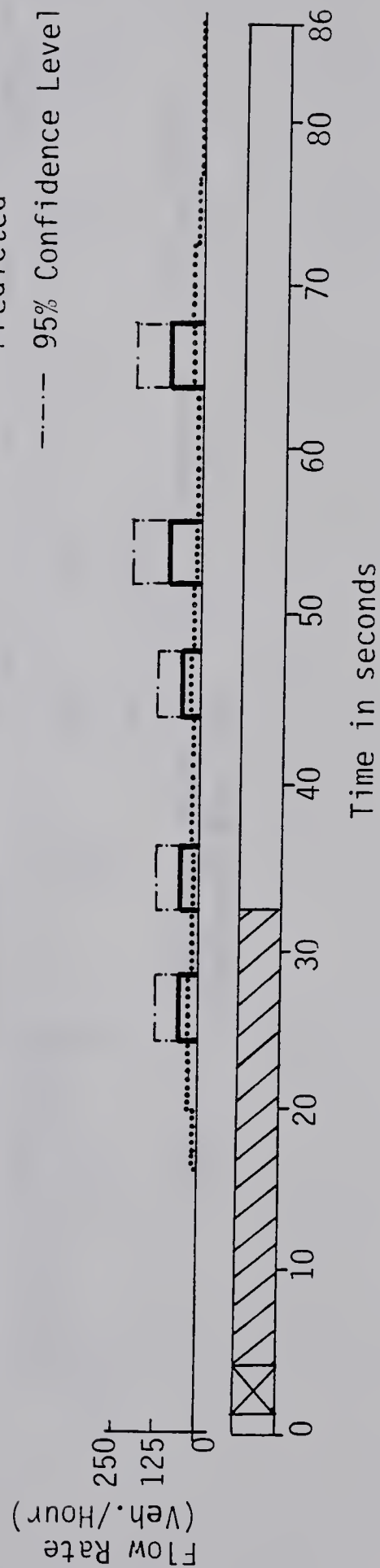


Figure V.16 Cyclic Flow Profile on Jasper Avenue and 112 Street (AM)
Eastbound Express Bus only)

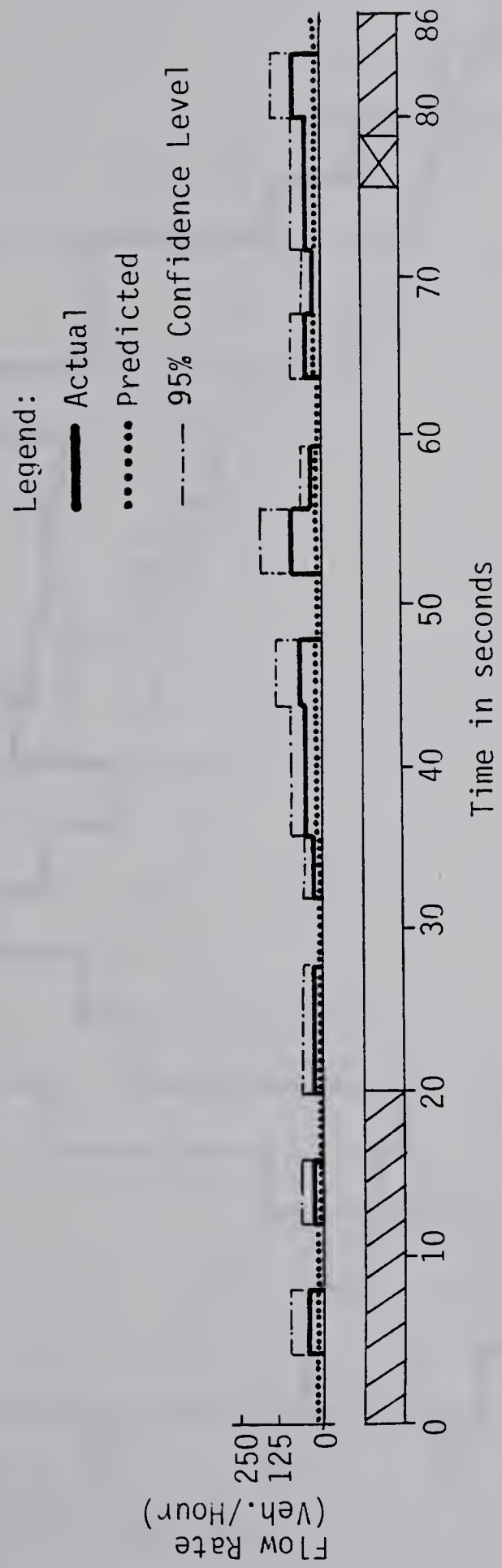


Figure V.17 Cyclic Flow Profile on Jasper Avenue and 114 Street (PM Westbound Bus only)

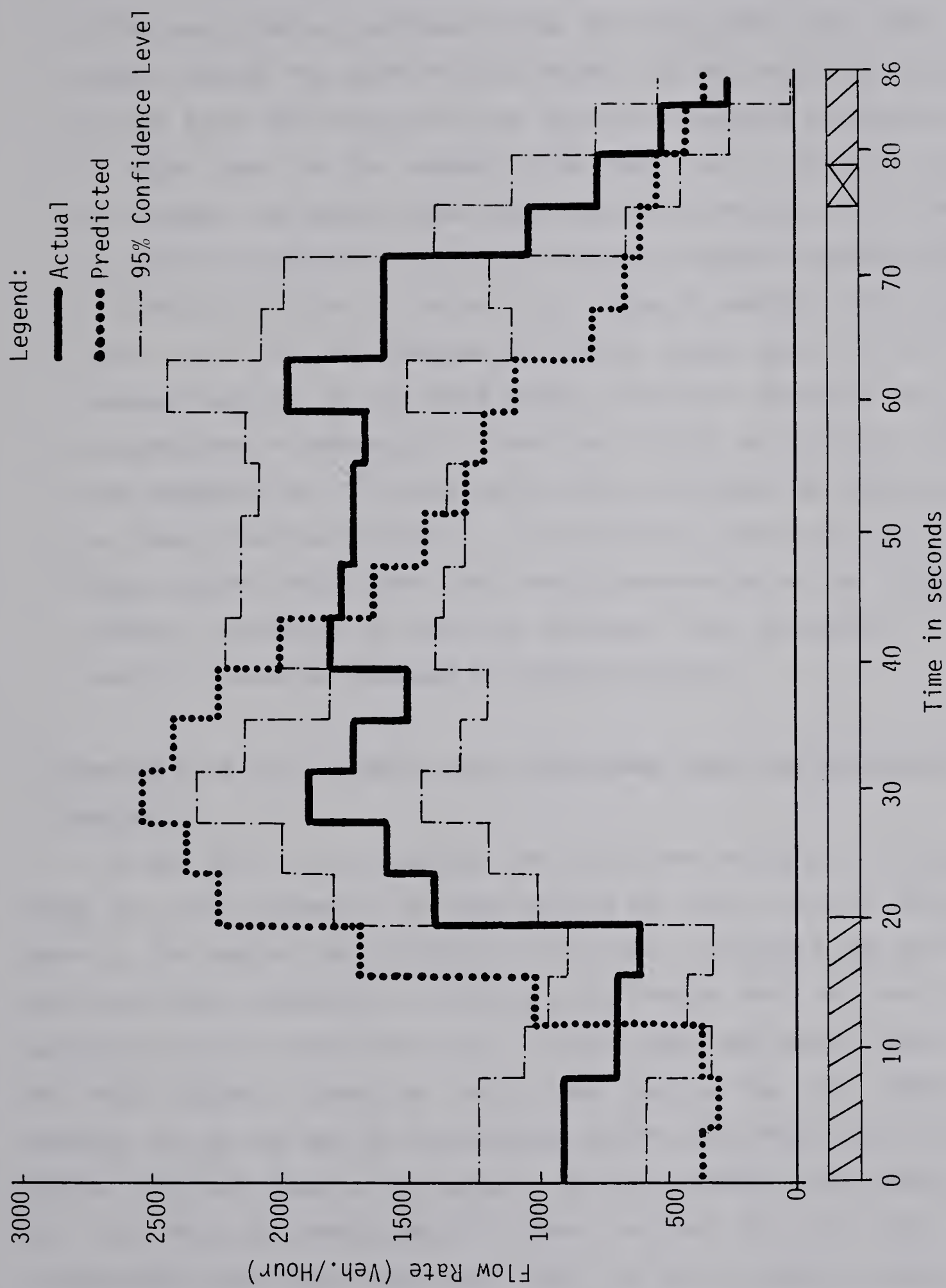


Figure V.18 Cyclic Flow Profile on Jasper Avenue and 114 Street (PM Westbound Auto only)

made in plotting the cyclic flow profile. In the *TRANSYT* program, the platoon of vehicles is dispersed and transferred from an upstream stopline to the next stopline downstream. During the survey, data were taken at a distance (beyond the maximum queue length) from the downstream stopline, and the cyclic flow profile was then shifted the equivalent displacement on the graph based on the assumption that there was no dispersion within that distance. The second cause was probably the empirical values used in the platoon dispersion formula. In the *TRANSYT* program, Robertson utilized a K value of 50 and a T value of 0.8 times the average travel time, in which 0.8 is the ratio between the platoon leader travel time and the average travel time of the entire platoon. These two parameters may not be appropriate in Edmonton. In a study by El-Reedy and Ashworth (18), it was suggested that 0.8 should not be fixed, but should be dependent on the locally observed distribution of travel time in order to account for those vehicles whose travel times were appreciably below the average. A calibrated combination of these two parameters could compensate for the diversity between the predicted and observed patterns.

F. ANALYSES OF THE TRANSIT DELAY WEIGHTING AND THE TIME-SPACE DIAGRAM

At this point, it was suspected that the offsets and splits of the signal timing plan were governed by the auto traffic in the "after" case. As described earlier in this chapter, the *TRANSYT* program uses a procedure that optimizes splits and offsets alternately by minimizing a performance index, and one of the constituents of this index is the sum of uniform delay and random delay times the delay weighting. When the traffic flow input is low, the degree of saturation will be low and its corresponding uniform and random delay will also be low. The input values in the eastbound direction averaged 1300 vehicles per hour for the auto traffic and 50 buses per hour for the transit. (The corresponding bus-to-auto ratio was 1:26.) The delay weighting assigned to

18 T.Y. El-Reedy, and R. Ashworth, "Platoon Dispersion Along a Major Road in Sheffield", *Traffic Engineering and Control*, April 1978, p.186.

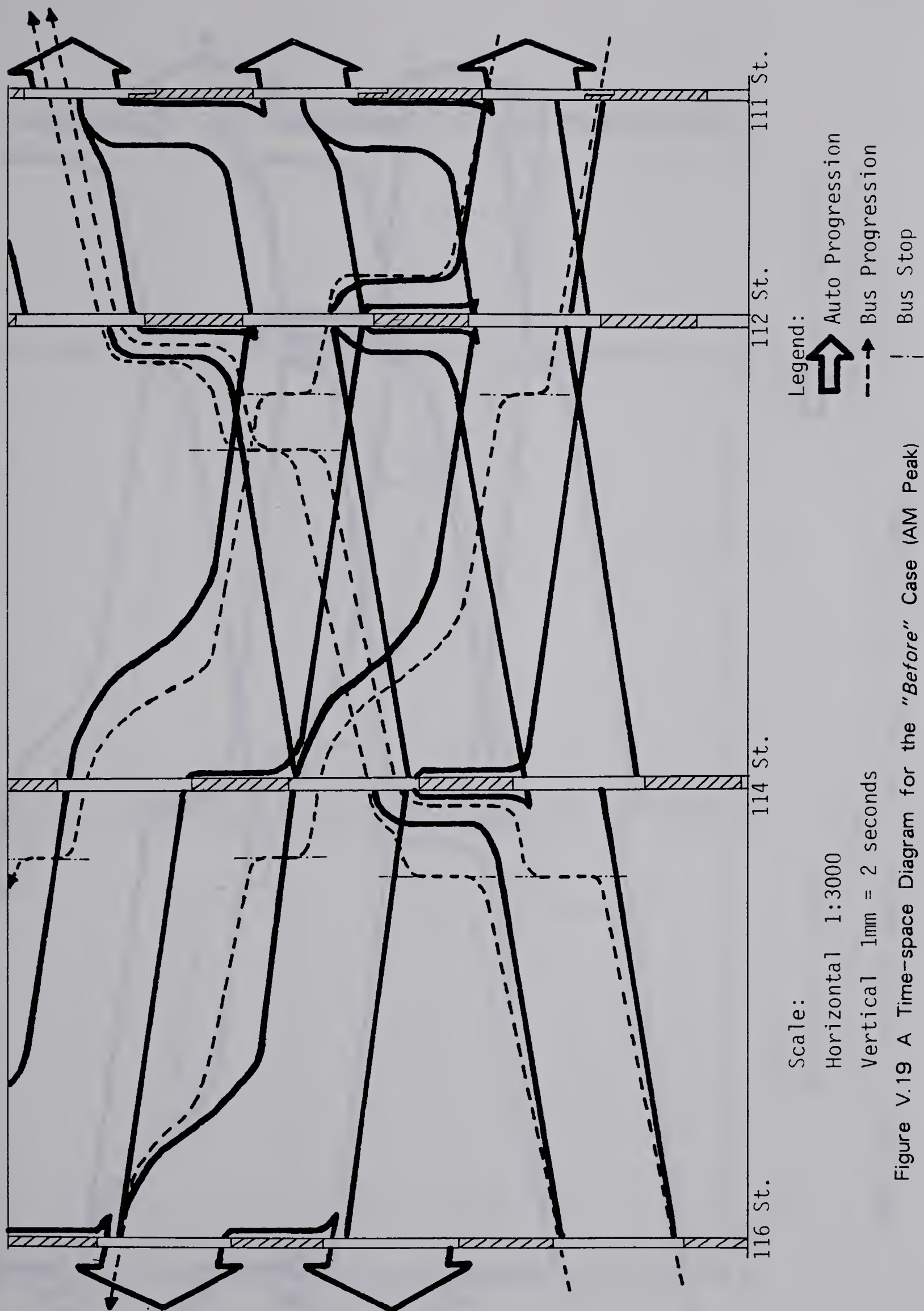
buses was 20. The final performance indices for the auto and bus movements were 265 and 16 respectively. The flow patterns between the morning peak "*before*" and "*after*" cases are generally the same, as shown in the two time-space diagrams, Figures V.19 and V.20 respectively. Perhaps through assigning a bus delay weighting higher than 20 the signal settings will be altered. A trial run of the simulation was then conducted, in which buses were assigned a delay weighting value of 30. The output is presented in Appendix XI. The summary of the final signal settings is shown in Table V.26, while Table V.27 is an abstract of the final signal setting obtained by assigning a bus delay weighting of 20. It was found that there was no difference between the two sets of signal settings. Next, two more cases were simulated, one utilizing a bus delay weighting of 10 and the other a value of 5. Tables V.28 and V.29 show the summary of the two sets of final signal settings, and the computer outputs are shown in Appendices XII and XIII respectively. Once again, the signal offsets and splits for all four cases are identical.

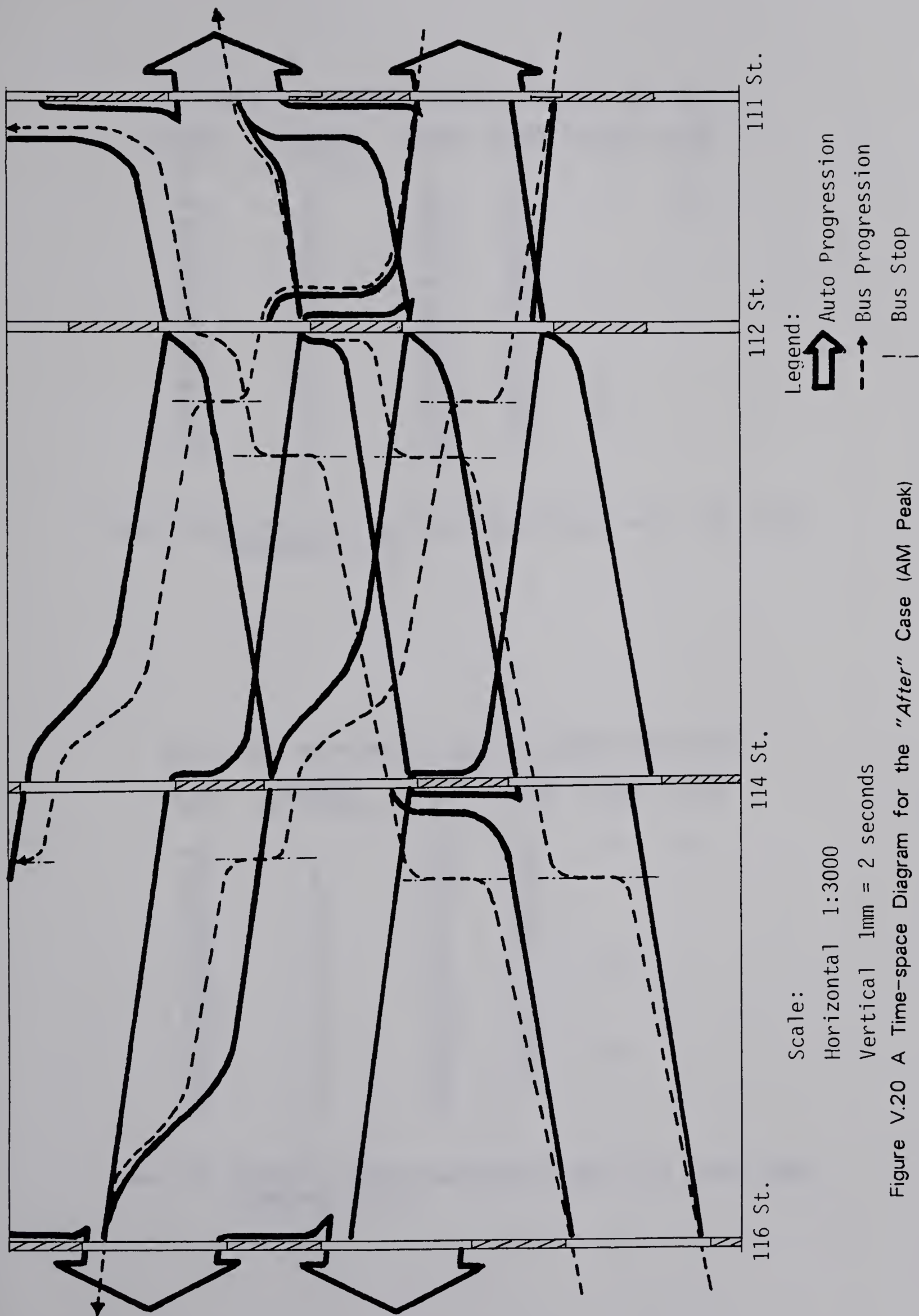
When the time-space diagrams of the "*before*" and "*after*" cases in the afternoon peak were compared, as shown in Figures V.21 and V.22, the times spent by buses in the study section were more or less the same. Thus, it was concluded that there is not enough bus volume in the "*after*" case to cause the *TRANSYT* program to give buses a significant preferential progression. And when the bus-to-auto ratio is equal to or less than 1:26, any value from 5 to 30 assigned to the bus delay weighting will give the same signal settings.

G. CONCLUSION

Although the application of the *BUS TRANSYT* program had been effective in England (19), this was not the case for the experiment here in Edmonton. The results of the "*before-and-after*" study showed that buses did not gain a significant improvement in travel time as expected. The reasons appear to be, first of all, that there was not enough bus volume in the study

19 D.I. Robertson and R.A. Vincent, "Bus Priority in a Network of Fixed-time Signals", *The Transport and Road Research Laboratory*, LR 666, 1975.





CBD WEST NETWORK - 108-121 STREET AM PEAK

NODE NO.	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4
46	4	20	36	7	10
48	2	16	3		
61	2	35	23		
65	2	3	36		
76	2	40	26		
81	2	5	34		
83	3	33	4	21	
85	2	35	22		
87	2	14	1		
89	2	33	20		
91	3	37	18	31	
93	2	32	22		
95	2	25	11		

Table V.26 Summary of the Final Signal Settings with a Bus Delay Weighting of 30

CBD WEST NETWORK - 108-121 STREET AM PEAK

NODE NO.	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4
46	4	20	36	7	10
48	2	16	3		
61	2	35	23		
65	2	3	36		
76	2	40	26		
81	2	5	34		
83	3	33	4	21	
85	2	35	22		
87	2	14	1		
89	2	33	20		
91	3	37	18	31	
93	2	32	22		
95	2	25	11		

Table V.27 Summary of the Final Signal Settings with a Bus Delay Weighting of 20

CBD WEST NETWORK - 108-121 STREET AM PEAK

NODE NO.	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4
46	4	20	36	7	10
48	2	16	3		
61	2	35	23		
65	2	3	36		
76	2	40	26		
81	2	5	34		
83	3	33	4	21	
85	2	35	22		
87	2	14	1		
89	2	33	20		
91	3	37	18	31	
93	2	32	22		
95	2	25	11		

Table V.28 Summary of the Final Signal Settings with a Bus Delay Weighting of 10

CBD WEST NETWORK - 108-121 STREET AM PEAK

NODE NO.	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4
46	4	20	36	7	10
48	2	16	3		
61	2	35	23		
65	2	3	36		
76	2	40	26		
81	2	5	34		
83	3	33	4	21	
85	2	35	22		
87	2	14	1		
89	2	33	20		
91	3	37	18	31	
93	2	32	22		
95	2	25	11		

Table V.29 Summary of the Final Signal Settings with a Bus Delay Weighting of 5

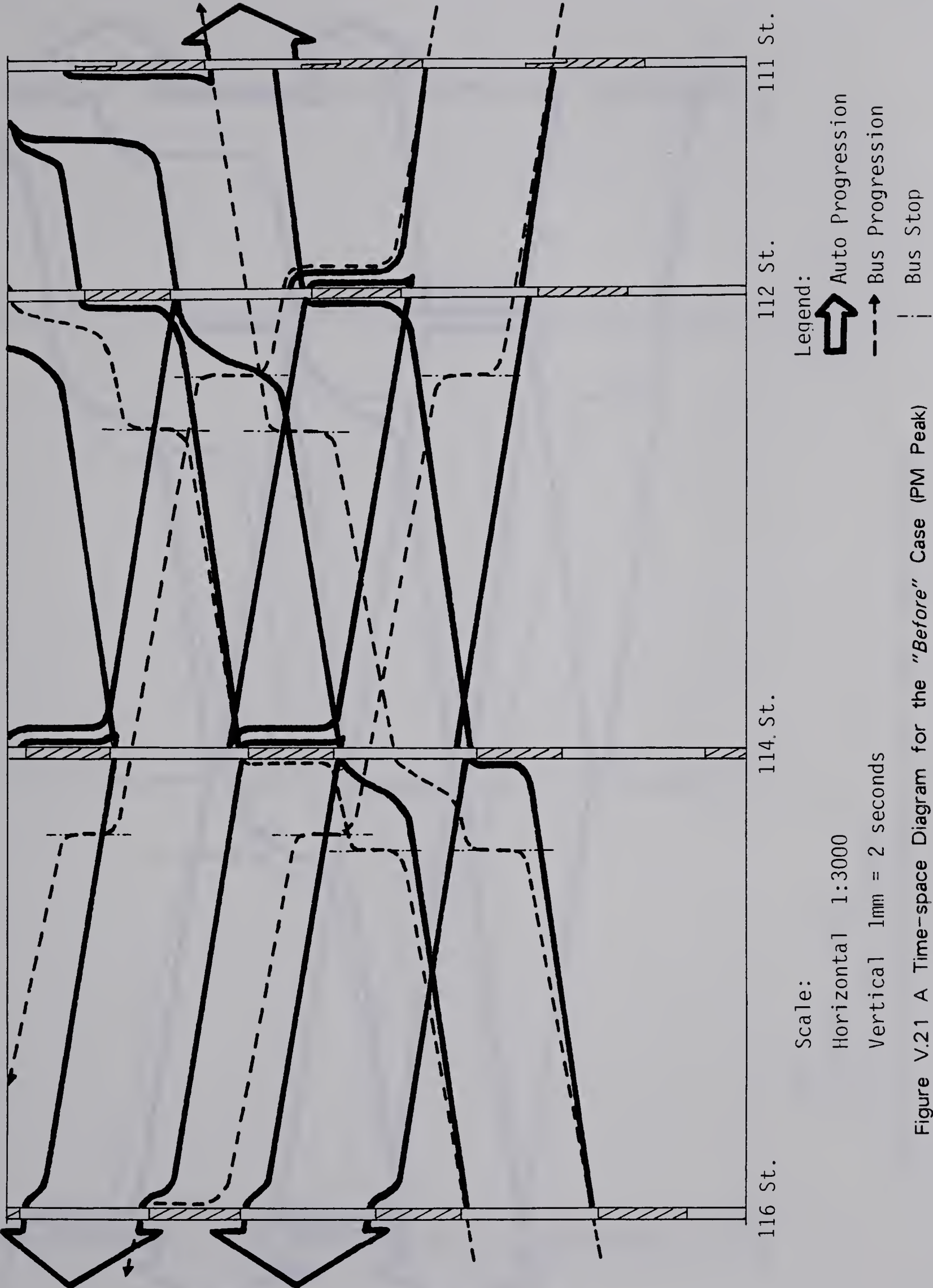
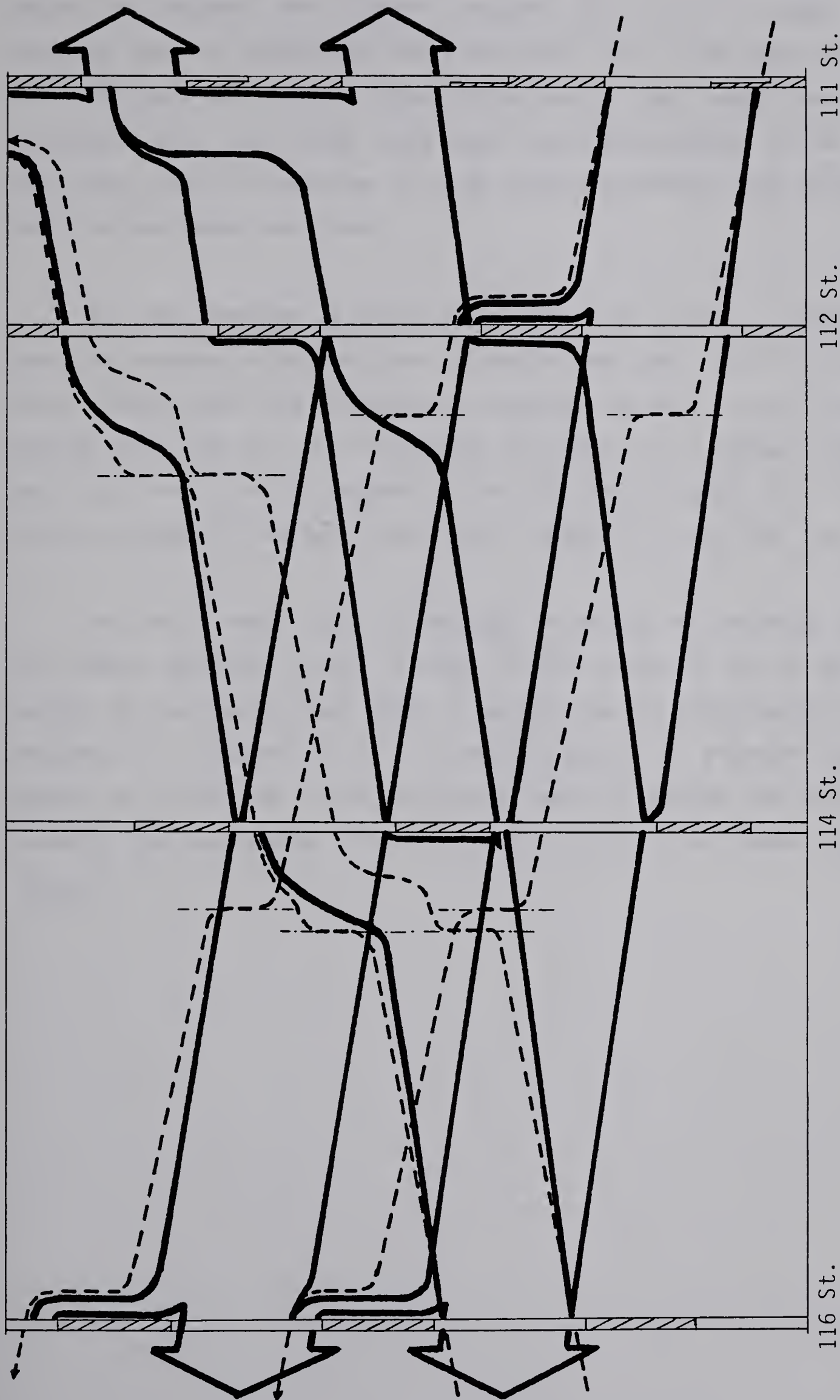


Figure V.21 A Time-space Diagram for the "Before" Case (PM Peak)



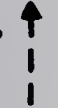
Scale:

Horizontal 1:3000

Vertical 1mm = 2 seconds

Legend:

 Auto Progression

 Bus Progression

 Bus Stop

Figure V.22 A Time-space Diagram for the "After" Case (PM Peak)

section to influence the *TRANSYT* program for a set of signal settings favouring the bus progression. The bus-to-auto ratio in the study section is 1:26. Secondly, the fixed-time signal setting used in the "*before*" case was a satisfactory one. Even though there were some improvements in the "*after*" case, they were not significant at a 95 percent confidence level because the basis for comparison was good.

For the simulation of buses in the *TRANSYT* program, it appears that when the express bus-to-auto ratio is equal or less than 1:93, it is not worth while spending extra time simulating two separate bus links for the regular and express buses. One bus link representing the regular bus is adequate. Moreover, any value from 5 to 30 assigned to the bus delay weighting will not affect the final outcome if the bus-to-auto ratio is equal to or less than 1:26.

For the K value, which is employed to modify the smoothing factor in the platoon dispersion formula, a value of 50 appears to be an appropriate number for the morning peak traffic. It appears that the difference between the measured and predicted cyclic flow profiles during the afternoon peak was caused by, firstly, the wrong assumption made in plotting the profile, and secondly, the inappropriate empirical parameters used in the platoon dispersion formula.

VI. CONCLUSIONS AND RECOMMENDATIONS

In the first part of this study, a transit travel time survey was conducted on 107 Avenue from 101 Street to 124 Street. The following findings were a result of this survey:

- 1) In the study section, total stopped-time delay accounted for 37.4, 39.0, and 41.0 percent of the transit travel time for the AM, Off, and PM peaks respectively. On the average, it was about 39 percent.
- 2) The delay at signals accounted for 13.2, 18.6, and 20.0 percent of the transit travel time during the AM, Off, and PM peaks respectively. On the average, it was about 17 percent.
- 3) The transit delay at signals constituted the highest percentage of the total stopped-time delay. It was 35.4, 47.7, and 48.8 percent of the total stopped-time delay for the AM, Off, and PM peaks respectively. On the average, it was about 44 percent.
- 4) There was no difference between the running speeds of the diesel and trolley buses at a 95 percent confidence level.

It appears that the second finding mentioned above was caused by the inefficient operation of the signal system in the study section. The six signalized intersections are traffic actuated and are interconnected in no way whatsoever. This means that each intersection will accommodate the traffic flows based on the detector information at that intersection alone. The arrival of a bus at the next intersection is purely a random event. It appears that in order to reduce delays and improve traffic flow, there is a strong need to operate these signals in a linked manner rather than in isolation. At this writing, the signals on 107 Avenue are operated as a linked system in a fixed-time mode.

In the second part of this thesis, a real-life *"before-and-after"* study was carried out on Jasper Avenue from 111 Street to 117 Street. The

conclusions were as follows:

- 1) It was found that buses did not gain a significant improvement in travel time as expected.
- 2) It appears that the cause was the low bus-to-auto ratio in the study section, 1:26, which caused the *TRANSYT* program to give a set of signal settings favouring the auto progression rather than that of the buses. Besides, the basis for comparison was good because the signal setting in the "*before*" case was a satisfactory one.
- 3) For the simulation of buses in the *TRANSYT* program, it appears that when the express bus-to-auto ratio is equal to or less than 1:93, it is not worth while spending extra time simulating two separate bus links for the regular stopping and non-stopping buses. One bus link with the stopping consideration will provide sufficient attention.
- 4) It appears that any value from 5 to 30 assigned to the transit weighting will give the same signal settings if the bus-to-auto ratio is equal to or less than 1:26.

Despite the results of the "*before-and-after*" study, it is still recommended that the simulation of buses be included in the optimization of the signal settings using *TRANSYT*. At least some benefits to buses (as shown in Tables V.20 and V.21), although not statistically significant, can be obtained merely by changes in the fixed-time signal settings. It is important to realize that no additional equipment is necessary for implementing the method once facilities are established for connecting the signalized intersections as a linked system. The only specific costs are the manpower and computing necessary to prepare the signal settings.

Although an "*active*" approach to benefit buses at an isolated intersection has been shown in the literature review, Chapter II, there is no evidence to

suggest that such a scheme would likely be beneficial in a network of signalized intersections. It is suspected that the total delays within the network would increase because of the frequent interruption of the signal settings in a demand-responsive system. It appears that the fixed-time scheme under the "*passive*" approach is a proven method to give buses priority in a network of signalized intersections.

It appears that the timing plan for the "*after*" case in this study was governed by the auto traffic. The cause was the low bus volume in the study section and perhaps an inadequate value assigned to the bus delay weighting. In the study section, which was located in the fringe area of the CBD, the bus flow is only 50 buses per hour. However, the bus flow in some areas within the CBD is as high as 120 buses per hour. This high volume of buses may cause the *BUS TRANSYT* program to produce a signal timing plan favouring the bus movement. Moreover, the bus delay weighting may also be assigned a value of 30 or higher which would result in a significant improvement to bus progression. Nevertheless, the effect on other traffic would have to be studied in detail. It is recommended that the investigation of these two cases to be carried out in some studies.

In the cyclic flow profile survey, it appears that a K value of 50, employed to modify the smoothing factor in the platoon dispersion formula, was an appropriate number for the morning peak traffic. It appears that the difference between the measured and predicted cyclic flow profiles during the afternoon peak was caused by, firstly, the wrong assumption made in plotting the profile and, secondly, the inappropriate empirical parameters used in the platoon dispersion formula. There is some reason to believe that these two parameters vary with roadway and traffic conditions. It is recommended that a future study be carried out in Edmonton to investigate the specific values for the empirical parameters in the platoon dispersion model.

Finally, the *BUSPAS* program was in operation at the time this thesis was written. It is recommended that a separate study be carried out to investigate the consequences of various signal priority schemes for transit using the *BUSPAS* program, and to find the best signal strategy for transit operation in Edmonton.

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APPENDIX I

Significance Testing of the Travel Time Data on 107 Avenue
from 101 Street to 124 Street

AM EASTBOUND

Routes 3 and 7 (Diesel)	n = 12	x = 24.11	s = 2.19
Route 4 (Trolley)	n = 11	x = 23.85	s = 1.80

Null hypothesis $H_0 : u_D = u_T$

Alternate hypothesis $H_1 : u_D \neq u_T$

$$\begin{aligned}
 t_0 &= \frac{\sqrt{\frac{n_1 n_2 (n_1 + n_2 - 2)}{n_1 + n_2}}}{\sqrt{\frac{(n_1 - 1)s_x^2 + (n_2 - 1)s_y^2}{n_1 + n_2 - 2}}} \frac{x - y}{\sqrt{\frac{(n_1 - 1)s_x^2 + (n_2 - 1)s_y^2}{n_1 + n_2 - 2}}} \\
 &= \frac{\sqrt{\frac{12 \times 11 (12 + 11 - 2)}{12 + 11}}}{\sqrt{\frac{11 \times 2.19^2 + 10 \times 1.80^2}{12 + 11 - 2}}} \frac{24.11 - 23.85}{\sqrt{\frac{11 \times 2.19^2 + 10 \times 1.80^2}{12 + 11 - 2}}} \\
 &= 0.309
 \end{aligned}$$

For 95% confidence

$$t_{.025, 21} = 2.080$$

$$> t_0$$

Therefore, null hypothesis is accepted.

That is, there is no difference between diesel and trolley speeds at a 95% level.

AM WESTBOUND

Routes 3 and 7 (Diesel) $n = 9$ $\bar{x} = 27.48$ $s = 2.16$

Route 4 (Trolley) $n = 10$ $\bar{x} = 26.99$ $s = 2.34$

Null hypothesis $H_0 : \mu_D = \mu_T$

Alternate hypothesis $H_1 : \mu_D \neq \mu_T$

$$t_0 = \frac{27.48 - 26.99}{\sqrt{\frac{9 \times 10 (9 + 10 - 2)}{9 + 10} \left(\frac{8 \times 2.16^2 + 9 \times 2.34^2}{9 + 10} \right)}}$$

$$= 0.472$$

For 95% confidence,

$$t_{.025, 17} = 2.110$$

$$> t_0$$

Therefore, null hypothesis is accepted.

In other words, there is no significant difference between the population mean of the diesel buses and the trolley buses running speeds.

AM EASTBOUND AND WESTBOUND

Eastbound (Diesel + trolley) $n = 23$ $\bar{x} = 23.99$ $s = 1.98$

Westbound (Diesel + trolley) $n = 19$ $\bar{x} = 27.22$ $s = 2.21$

Null hypothesis $H_0 : \mu_{\text{east}} = \mu_{\text{west}}$

Alternate hypothesis $H_1 : \mu_{\text{east}} \neq \mu_{\text{west}}$

$$t_0 = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}} = \frac{23.99 - 27.22}{\sqrt{\frac{1.98^2}{23} + \frac{2.21^2}{19}}} = 4.993$$

For 95% confidence,

$$t_{.025, 40} = 2.021$$

$$2.021 < t_0$$

Since the result is significant at the 5% level, the null hypothesis is rejected. That is, the population mean of the eastbound speed is not equal to the westbound speed.

OFF-PEAK

Since there is no trolley buses running during off-peak hours, we only considered the eastbound and westbound speed.

EASTBOUND (Diesel)	n = 20	x = 26.83	s = 1.78
WESTBOUND (Diesel)	n = 19	x = 27.97	s = 2.53

Null hypothesis $H_0 : u_{\text{east}} = u_{\text{west}}$

Alternate hypothesis $H_1 : u_{\text{east}} \neq u_{\text{west}}$

$$t_o = \frac{\frac{20 \times 19 (20 + 19 - 2)}{20 + 19} \frac{27.97 - 26.83}{\sqrt{19 \times 1.78^2 + 18 \times 2.53^2}}}{1.634}$$

For 95% confidence,

$$t_{.025, 37} = 2.021$$

$$> t_o$$

Therefore, the null hypothesis is accepted. There is no difference between the population mean of the running speed for the eastbound and westbound movement.

PM EASTBOUND

Routes 3 and 7 (Diesel)	n = 12	x = 25.60	s = 2.21
Route 4 (Trolley)	n = 9	x = 25.29	s = 3.23

Null hypothesis $H_0 : u_D = u_T$

Alternate hypothesis $H_1 : u_D \neq u_T$

$$t_0 = \frac{12 \times 9 (12 + 9 - 2)}{12 + 9} \frac{25.60 - 25.29}{\sqrt{11 \times 2.21^2 + 8 \times 3.23^2}}$$

$$= 0.262$$

For 95% confidence,

$$t_{.025, 19} = 2.093$$

$$> t_0$$

Therefore, null hypothesis is accepted. The population mean of the diesel running speed is equal to the population mean of the trolley running speed.

PM WESTBOUND

Routes 3 and 7 (Diesel)	n = 10	x = 24.49	s = 3.32
Route 4 (Trolley)	n = 13	x = 26.49	s = 4.07

Null hypothesis $H_0 : u_D = u_T$

Alternate hypothesis $H_1 : u_D \neq u_T$

$$t_0 = \frac{10 \times 13 (10 + 13 - 2)}{10 + 13} \frac{26.49 - 24.49}{\sqrt{9 \times 3.32^2 + 12 \times 4.07^2}}$$

$$= 1.262$$

For 95% confidence,

$$t_{.025, 21} = 2.080$$

$$> t_0$$

Therefore, the null hypothesis is accepted. The population mean of the diesel running speed is equal to the population mean of the trolley running speed.

PM EASTBOUND AND WESTBOUND

Eastbound (Diesel + trolley)	n = 21	x = 25.47	s = 2.62
Westbound (Diesel + trolley)	n = 23	x = 25.62	s = 3.82

Null hypothesis $H_0 : u_{\text{east}} = u_{\text{west}}$

Alternate hypothesis $H_1 : u_{\text{east}} \neq u_{\text{west}}$

$$t_0 = \frac{25.62 - 25.47}{\sqrt{\frac{21 \times 23 (21 + 23 - 2)}{21 + 23} \left(\frac{2.62^2}{20} + \frac{3.82^2}{22} \right)}}$$

$$= 0.150$$

For 95% confidence,

$$t_{0.025, 42} = 2.021$$

$$> t_0$$

Again, the null hypothesis is accepted. The population mean of the eastbound speed is equal to the population mean of the westbound speed.

APPENDIX II

Computer Output of the *BUSPAS* Program

STOPLINE DATA

*	111*	311	1	11	162	*	112*	0	0	11	0	211*	411	1	11	162
	341	83	2	11	60		155	83	2	11	12	441	41	1	11	60
	241	-1	1	11	60		0	0	0	0	0	341	-1	2	11	60
	441	-1	1	11	60		0	0	0	0	0	141	-1	2	11	60
*	212*	0	0	11	0	*	311*	111	1	11	162	312*	0	0	11	0
	223	41	1	11	123		141	83	2	11	60	355	83	2	11	12
	0	0	0	0	0		441	-1	1	11	60	0	0	0	0	0
	0	0	0	0	0		241	-1	1	11	60	0	0	0	0	0
*	411*	211	1	11	162	*	412*	0	0	11	0					
	241	41	1	11	60		423	41	1	11	123					
	141	-1	2	11	60		0	0	0	0	0					
	341	-1	2	11	60		0	0	0	0	0					

DETECTOR DATA

*	121*	2	111	1	12	2	2000	1000
*	122*	2	121	2	12	2	2000	1000
*	123*	2	122	2	15	2	2000	1000
*	151*	5	123	2	12	2	2000	1000
*	152*	5	151	5	22	2	2000	1000
*	153*	5	152	5	22	2	2000	1000
*	154*	5	153	5	22	2	2000	1000
*	155*	5	154	5	22	2	2000	1000
*	124*	2	112	1	12	2	0	0
*	221*	2	211	1	12	1	2000	1000
*	222*	2	221	2	12	1	2000	1000
*	223*	2	222	2	15	1	2000	1000
*	224*	2	212	1	12	1	0	0
*	321*	2	311	1	12	2	2000	1000
*	322*	2	321	2	12	2	2000	1000
*	323*	2	322	2	15	2	2000	1000
*	351*	5	323	2	12	2	2000	1000
*	352*	5	351	5	22	2	2000	1000
*	353*	5	352	5	22	2	2000	1000

* 355*	5	354	5	22	2	2000	1000
* 324*	2	312	1	12	2	0	0
* 421*	2	411	1	12	1	2000	1000
* 422*	2	421	2	12	1	2000	1000
* 423*	2	422	2	15	1	2000	1000
* 424*	2	412	1	12	1	0	0

ENTRY DATA

* 131*	4160	124	0	* 231*	2220	224	0	* 331*	4160	324	0
* 431*	2220	424	0								

EXIT DATA

DETECTOR, NUMBER OF CARS WHEN THE LIGHTS ARE RED AND GREEN											
121	4	2	122	4	2	123	5	3	151	4	2
153	7	4	154	7	4	155	7	4	124	4	2
222	2	1	223	2	1	224	2	1	321	4	2
323	5	3	351	4	2	352	7	4	353	7	4
355	7	4	324	4	2	421	2	1	422	2	1
424	2	1									

VEHICLE LENGTH 6

END TIME 900

VELOCITY RANGE 20

ENTRY SPEED 30

RANDOM NUMBER SEED 5760076

NUMBER OF VEHICLES 200

JUNCTION SIGNAL DATA
HFACT 3

* 1	3	3	0	0	* 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
111	7	311	7	211	7	411	7		0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V.A. EXTENSION = 4																			
1*																			
2																			
25	65	123	323	121	321	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	42	223	423	221	421	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SPECIAL VEHICLE DATA

S.V. EXTENSION = 1 5 124 0 11 0 0 1
4 NUMBER OF DEMAND DETECTORS = 1

JUNCTION 1	START TIME	TOTAL GREEN TIME AND NUMBER OF TIMES GREEN							AV. J-T
		STAGE 1	STAGE 2	STAGE 3	STAGE 4	STOPS	FLOW	JOURNEY TIME	
	1	0	0	0	0	0	0	0	0.0
	1	0	0	0	0	0	0	0	0.0
	1	0	0	0	0	0	0	0	0.0
	1	0	0	0	0	0	0	0	0.0
	1	0	0	0	0	0	0	0	0.0
	1	0	0	0	0	0	0	0	0.0
	1	0	0	0	0	0	0	0	0.0
	1	0	0	0	0	0	0	0	0.0
	1	0	0	0	0	0	0	0	0.0
	1	0	0	0	0	0	0	0	0.0

DECISION INFLOW OUTFLOW

131	0	0
231	0	0
331	0	0
431	0	0
141	0	0
241	0	0
341	0	0
441	0	0

TOTAL INFLOW
INFLOW THIS PERIOD

0 TOTAL OUTFLOW
0 OUTFLOW THIS PERIOD

I VALUES FOR ENTRY POINTS

0 VEHICLES IN SYSTEM AT
131UUUUU 231UUUUU 331UUUUU 431UUUUU

APPENDIX III

BUSPAS Output from The Transport and Road Research Laboratory

RELATION PRINT OF PAGES:K=200 ,STOP (SOURCE)/P FOR USER P09203

RUN 0010

PRINT IN PAGES: K=200 (COMPRES AS K=200 YSL5%) STARTED 30/10/75 19:51:30

	SP. VER.	1	START-TIME	93
101	JUNCTION	1	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION	
102	JUNCTION	1	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION	
103	JUNCTION	1	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION	
104	JUNCTION	1	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION	
105	JUNCTION	1	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION	
106	JUNCTION	1	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION	
107	JUNCTION	1	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION	
108	JUNCTION	1	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION	
109	JUNCTION	1	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION	
110	JUNCTION	1	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION	

START-TIME 93

DELAY	DIST	END-TIME
0	162	
---	---	
0	162	110

110

111	JUNCTION	1	CHANGE 2	OCCURRING STAGE = 2	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION
112	JUNCTION	1	CHANGE 2	OCCURRING STAGE = 2	V.A. CHANGE OVERRIDEN BY S.V. EXTENSION
113	JUNCTION	1	CHANGE 2	OCCURRING STAGE = 2	
114	JUNCTION	1	CHANGE 1	OCCURRING STAGE = 1	

START-TIME 163

DELAY	DIST	END-TIME
0	162	
---	---	
0	162	163

163

111	JUNCTION	1	CHANGE 2	OCCURRING STAGE = 2
112	JUNCTION	1	CHANGE 2	OCCURRING STAGE = 2
113	JUNCTION	1	CHANGE 2	OCCURRING STAGE = 2
114	JUNCTION	1	CHANGE 1	OCCURRING STAGE = 1

TOTALS

DATA FOR 7200 SECONDS ENDING AT 7500

STATION	AVERAGE JOURNEY TIME X 1000	STANDARD ERROR	FREE JOURNEY TIME X 1000	DELAY SECONDS PER HOUR	STANDARD ERROR	STOPS PER HOUR	FLOW VEHICLES PER HOUR	DISTANCE
111	55131	518.29	16200	46474	589.59	4386	1193	162
211	41681	538.02	11571	27308	455.71	3037	904	162
311	51563	546.07	11571	40256	969.39	5551	1206	162
411	43755	1120.1	11571	25450	836.88	2945	884	162

NUMBER OF RECTIONS FOR THE STANDARD ERRORS 4

VEHICLE HOURS PER HOUR 50.89041007
VEHICLE MILES PER HOUR 677.6180000

TOTAL GREEN TIME AND NUMBER OF TIMES GREEN

STAGE 1	STAGE 2	STAGE 3	STAGE 4
2795	5039	0	0

PLS JOURNEY 1 NUMBER OF PHASES 20 AVERAGE JOURNEY TIME 35.24 STANDARD ERROR 2.660

No Priority

main road delay = 26.54 veh. h/h

side road delay = 16.60

total vehicle = 42.94

bus delay = 39.05

delay (s h...)

112	33
212	1624
312	78
412	2303

APPENDIX IV

Listing of the *BUSPAS* Program


```

1  C  PRDGRAM RDSIM
2  IMPLICIT INTEGER (A-Z)
3  INTEGER*4 MSEC, NDUT, BM, JTST, NPER, BUS, TEMP
4  INTEGER*4 JUN, DET, ENTRY, JST, EST, DST, CARS, DTCN, NSTDP, DUTDAT, CDUT,
5  1MLANE, BLANE, LTH, VELD, DETINT,
6  2JNST, DCARS, HIST, SVSTRT(100),
7  3MIN, MAX, EXTT, MINGT, MAXGT, NST, DEMDET, EXTDET, DEM, NDST
8  INTEGER*4 NGRN(28,4), NGREEN(28,4), GRNT(28,4), GREENT(28,4)
9  INTEGER*4 CHENT(40,4), CHADEL(120,4), CHADER(120,4)
10  INTEGER*4 FRCCNG(28,4,4), NSVEX(28,4,4), NWGP, NWMX, DVTK
11  INTEGER*4 SVDMDT(28,4,2), SVEXTT(28), SVEXDT(28,4,6), SVDEM(28,4),
12  1 SVMXGT(28), SVMAX(28,4), EXTRGN(28,4), EXGN(28,4)
13  REAL*8 TIM
14  DIMENSION JUN(75,30), DET(120,15), DECTR(75), ENTRY(40,6),
15  1JST(75), DST(120), EST(40), CARS(750,4), JTST(75), DTCN(75),
16  2DLY(75), NSTDP(75), DUTDAT(12,3), CDUT(5,2),
17  3SATN(3), CDUN(5), OCN(3),
18  4TLST(28,23), JNST(28), CHANGE(28,2),
19  5MLANE(6,8), BLANE(6,4), LTH(75), VELD(75), DETINT(120),
20  6DUMJUN(4), MASTJN(4),
21  7MIN(28,4), MAX(28,4), EXTT(28), MINGT(28), MAXGT(28), NST(28,4),
22  8DEMDT(28,4,2), EXTDET(28,4,6), DEM(28,4), NDST(28)
23  CDMMDN JUN, DET, DECTR, ENTRY, JST, DST, EST, CARS, MSEC,
24  1JTST, DTCN, DLY, NSTDP, DUTDAT, CDUT, NDUT, NPER,
25  2MLANE, BLANE, LTH, VELD, DETINT, BM, BUS
26  CDMMDN/CDM1/SATN, CDUN, OCN, VLTH,
27  1ENDT, RNGE, SPEED, NVEH, UCST, LCST, RN, ODELAY
28  CDMMDN/CDM2/TLST, JNST, CHANGE, HFACT, NDUM, DUMJUN, MASTJN,
29  1MIN, MAX, EXTT, MINGT, MAXGT, NST, DEMDET, EXTDET, DEM, NDST, NJN, EXT
30  CDMMDN /BLKSVH/ SVST(100,11), SVDL(100,5), NSPVEH, START,
31  1 SVSTRT, IPRINT
32  CDMMDN /BLKTIM/ PCHNGE(28), MNJN, NGRN, NGREEN, GRNT, GREENT
33  CDMMDN /BLKCMP/ SVOMDT, SVEXTT, SVEXDT, SVMXGT, SVMAX, SVDEM,
34  1 EXTRGN, EXGN, SVEXT, 1CDMP, 1CHDP, NNSKIP, IRUN, FST
35  CDMMDN /BLKFLD/ CHND, TIMCH(4), CHENT, CHADEL, CHADER, NDCHTT
36  CDMMDN /BLKFCG/ FRCCNG, NSVEX, NWGP, NWMX
37  CDMMDN /BLKHST/ DCARS(750), HIST(75,20), HSTINC
38  CDMMDN /BLK1/ NSTRT(40), SUMN(40), SNSQ(40), TNSTRT(40), TSUMN(40),
39  1 TSNSQ(40), NM(40)
40  CDMMDN /BLKTKE/ DVTK(120)
41  CDMMDN /BLKMLT/ ENT(20,5)
42  1002 FDRMAT('1', ' ')
43  1003 FDRMAT(' ', G10.1, ' MSEC = ', G8)
44  1006 FDRMAT(' ', ' ')
45  1011 FDRMAT(' ', T20, 'TIME ', G10)
46  1023 FDRMAT('0', T20, 'JUNCTIDN', T32, 'DELAY')
47  1024 FDRMAT(' ', T16, G10, T27, G10)
48  1025 FDRMAT(' ', 'MAXIMUM VEHICLES IN SYSTEM', G10)
49  1100 FDRMAT(' ', T20, 'RANDDM NUMBER', G10)
50  -----
51  C  READ IN DATA FDR DECISIONS AND LIGHTS
52  CALL READ
53  NN = CDUN(2)
54  C  READ IN TRAFFIC LIGHTS DATA
55  CALL TREAD
56  CALL VAREAD
57  WRITE(6,1008)
58  WRITE(6,1008)
59  -----
60  C  READ IN DATA FDR CDUNT DF CARS AT ENTRY

61  N1 = CDUN(2)
62  C  READ IN DATA FDR SPECIAL VEHICLES
63  CALL SSVH(N1)
64  C  READ IN SPECIAL VEHICLE DETECTOR DATA.
65  CALL SVREAD(NDEMD)
66  CALL DATA(CDUN(1), CDUN(2), CDUN(3), CDUN(5))
67  CALL GRAPHS(CDUN(1))
68  C  CALL STXIT
69  WRITE(6,1002)
70  C  CALL CDMNT('RDSIMS')
71  C  CALL CLDCK1
72  MSEC = 1
73  TEMP = TEMP + 1
74  Y=0
75  -----
76  C  START DF MAIN CYCLE
77  C  START RUNNING THRUUGH TRAFFIC LIGHTS DATA
78  C  CALL CLOCK(TIM)
79  C  WRITE(6,1003) TIM,MSEC
80  WRITE(6,2003) MSEC
81  2003 FDRMAT(' ', ' MSEC = ', G8)
82  12 CALL VACT
83  C  SPECIAL VEHICLE PRIDRITY ROUTINE.
84  CALL SVACT(NDEMD)
85  CALL TLIGHT
86  C  INITIATE SPECIAL VEHICLES
87  CALL ISVH
88  CALL GRAPH1
89  -----
90  C  START RUNNING THRUUGH JUNCTION DATA
91  16 CALL JMW01
92  -----
93  C  START RUNNING THRUUGH DETECTOR DATA
94  CALL DMW01
95  -----
96  C  START RUNNING THRUUGH ENTRY AND EXIT DATA
97  CALL FLDCH
98  CALL EMW01
99  CALL D1
100  -----
101  C  IF(NPER.EQ.0)GD TD 2778
102  DO 922 I=1,NPER
103  IF((MSEC.GE.CDUT(I,1)).AND.(MSEC.LE.CDUT(I,2)))GD TD 822
104  922 CONTINUE
105  GD TD 2778
106  822 WRITE(6,1011)MSEC
107  WRITE(6,1008)
108  DO 722 J=1,NDUT
109  WRITE(6,1008)
110  A=DUTDAT(J,1)
111  B=DUTDAT(J,2)
112  C=DUTDAT(J,3)
113  CALL DUT(A,B,C)
114  722 CONTINUE
115  GD TD 922
116  C9022 CALL CLDCK(TIM)
117  9022 TEMP = TEMP - 500
118  C  WRITE(6,1003) TIM,MSEC
119  WRITE(6,2003) MSEC
120  2778 IF (TEMP - 500) 823,9022,9022

```



```

121      823 MSEC = MSEC + 1
122      TEMP = TEMP + 1
123      IF(MSEC.EQ.ENOT)GO TO 23
124      GO TO 12
125      C 23 CALL COMENT(ROSIM7)
126      C 23 CALL CLOCK(TIM)
127      C WRITE(6,1003) TIM,MSEC
128      23 WRITE(6,2003) MSEC
129      CALL O2
130      CALL SPV3
131      WRITE(6,1025) LCST
132      STOP
133      ENO
134      SUBROUTINE OMWO1
135      C DETECTOR DECISION ROUTINE
136      IMPLICIT INTEGER(A-Z)
137      INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
138      INTEGER*4 JUN, OET, ENTRY, JST, EST, OST, CARS, OTCN, NSTOP, OUTOAT, COUT,
139      1MLANE, BLANE, LTH, VELO, OETINT, OCARS, HIST, OVTK
140      REAL*8 TIM
141      DIMENSION JUN(75,30), OET(120,15), OECTR(75), ENTRY(40,6),
142      1JST(75), OST(120), EST(40), CARS(750,4), JTST(75), OTCN(75),
143      2OLY(75), NSTOP(75), OUTOAT(12,3), COUT(5,2),
144      3SATN(3), COUN(5), OCN(3),
145      4MLANE(6,8), BLANE(6,4), LTH(75), VELO(75), OETINT(120)
146      COMMON JUN, OET, OECTR, ENTRY, JST, OST, EST, CARS, MSEC,
147      1JTST, OTCN, OLY, NSTOP, OUTOAT, COUT, NOUT, NPER,
148      2MLANE, BLANE, LTH, VELO, OETINT, BM, BUS
149      COMMON/COM1/SATN, COUN, OCN, VLTH,
150      1ENOT, RNGE, SPEED, NVEH, UCST, LCST, RN, ODELAY
151      COMMON /BLKHST/ OCARS(750), HIST(75,20), HSTINC
152      1 PL = 0
153      2 PL = PL + 1
154      GO TO 5
155      3 IF(PL.EQ.COUN(2))GO TO 4
156      GO TO 2
157      4 RETURN
158      5 ORCN = 0
159      ORCNB = 0
160      ORCNL = 0
161      ORCNR = 0
162      VVEL = 0
163      FVEH = 0
164      LVEH = 0
165      COUNT = 0
166      CCNP = 0
167      TYPE = 0
168      TYPET = 0
169      OETINT(PL)=0
170      BM=0
171      TYPER = 0
172      TYPEL = 0
173      TYPEB = 0
174      OECT = 0
175      OECR = 0
176      OECL = 0
177      OECB = 0
178      NSL = 0
179      NSLR = 0
180      NSLL = 0

```

```

181      NSLB = 0
182      BCOUNT=0
183      SVCN = 0
184      MARK = 0
185      TYPE = OET(PL,10)
186      IF(OET(PL,2).EQ.0) GO TO 29
187      TYPET = OET(PL,12)
188      OECT = OET(PL,3)
189      IF(TYPET.EQ.1)GO TO 6
190      VOUE = OET(OECT,6)
191      TEMP1 = OET(OECT,3)
192      TEMP2 = OET(OECT,12)
193      IF(TEMP2.EQ.1)GO TO 8
194      7 TEMP2 = OET(TEMP1,12)
195      TEMP1 = OET(TEMP1,3)
196      IF(TEMP2.NE.1) GO TO 7
197      8 NSL = TEMP1
198      GO TO 9
199      6 VOUE = JUN(OECT,24)
200      NSL = OECT
201      9 TEMP = OET(PL,5)
202      IF (JUN(NSL,12)) 60,60,61
203      60 IF (JUN(NSL,13)) 62,62,61
204      62 IF (JUN(NSL,14)) 63,63,61
205      63 NUMCR = OET(PL,14)
206      GO TO 82
207      61 NUMCR = OET(PL,15)
208      82 OEOU = NUMCR - VOUE
209      AVEH = OET(PL,1)
210      LOU = OET(PL,5) + 1
211      IF(TYPE-7)11,100,200
212      11 CARS(AVEH,1) = CARS(AVEH,1) - 1
213      12 IF(CARS(AVEH,1).LE.0) GO TO 16
214      13 IF(FVEH.EQ.0) GO TO 15
215      CARS(LVEH,4) = AVEH
216      14 LVEH = AVEH
217      CCNP = CCNP + 1
218      IF(CARS(AVEH,4).EQ.0) GO TO 29
219      AVEH = CARS(AVEH,4)
220      CARS(LVEH,4) = 0
221      GO TO 11
222      15 FVEH = AVEH
223      GO TO 14
224      16 COUNT = COUNT + 1
225      LOU = LOU - 1
226      IF (CARS(AVEH,3).LT.0.AND.LOU.GT.0) BCOUNT = BCOUNT + 1
227      IF((CARS(AVEH,1)+1).EQ.0) NSTOP(NSL) = NSTOP(NSL) + 1
228      17 IF(TYPE-7)18,150,250
229      18 IF(TYPE.EQ.6.AND.CARS(AVEH,3).LT.0)GO TO 320
230      318 OEOU = OEOU - 1
231      50 IF (OEOU.LT.0) GO TO 34
232      19 ORCN = ORCN + 1
233      IF(CARS(AVEH,3).LE.0)GO TO 20
234      VVEL = CARS(AVEH,3)
235      GO TO 21
236      20 VVEL = -CARS(AVEH,3)
237      SVCN = SVCN + 1
238      21 J = OET(PL,4)/VVEL
239      K = ((OET(PL,4) - J*VVEL)*10000)/VVEL
240      RNS = CCUBFS(10000) + 1

```



```

241 IF(K.GT.RNS) J = J + 1
242 CARS(AVEH,1) = J
243 MARK = 1
244 DECX = DECT
245 NSLX = NSL
246 TYPEX = TYPET
247 IF(CARS(AVEH,3).LE.0) GO TO 31
248 23 IF(TYPEX.NE.1) GO TO 26
249 IF(JUN(DECX,2).EQ.0) GD TO 25
250 NCAR = JUN(DECX,2)
251 CARS(NCAR,4) = AVEH
252 24 NCAR = CARS(AVEH,4)
253 JTST(DECX) = JTST(DECX) + CARS(AVEH,1)
254 CARS(AVEH,4) = 0
255 JUN(DECX,2) = AVEH
256 AVEH = NCAR
257 JUN(DECX,24) = JUN(DECX,24) + 1
258 IF(AVEH.EQ.0) GO TO 29
259 GO TO 11
260 25 JUN(DECX,1)=AVEH
261 GD TO 24
262 26 IF(DET(DECX,2).EQ.0) GD TO 28
263 NCAR = DET(DECX,2)
264 CARS(NCAR,4) = AVEH
265 27 NCAR = CARS(AVEH,4)
266 JTST(NSLX) = JTST(NSLX) + CARS(AVEH,1)
267 CARS(AVEH,4)=0
268 OET(OECX,2) = AVEH
269 AVEH = NCAR
270 DET(DECX,6) = DET(DECX,6) + 1
271 IF(AVEH.EQ.0) GD TO 29
272 GO TO 11
273 28 OET(OECX,1) = AVEH
274 GD TO 27
275 29 OET(PL,1) = FVEH
276 DET(PL,2) = LVEH
277 DET(PL,6) = CCNP
278 DET(PL,7) = DRCN
279 IF(TYPE.NE.2) GO TO 30
280 DETINT(PL)=DRCN+SVCN*100
281 IF(DETINT(PL).EQ.0.AND.COUNT.GT.0) DETINT(PL) = 20
282 IF (SVCN.EQ.0.AND.BCDUNT.GT.0) OETINT(PL)=DETINT(PL)+2000
283 GO TO 40
284 30 IF (TYPE.NE.5) GO TO 40
285 OETINT(PL)=SVCN*100
286 IF(DETINT(PL).EQ.0.AND.BCOUNT.GT.0)OETINT(PL)=2000
287 GO TO 40
288 31 X=2
289 IF(TYPET.EQ.1)X=1
290 CALL SVEH(2,PL,AVEH,X,DECT)
291 GO TO 23
292 33 OCARS(AVEH) = OCARS(AVEH) + 1
293 GO TO 13
294 34 DCARS(AVEH) = OCARS(AVEH) + 1
295 GD TO 13
296 35 OCARS(AVEH) = OCARS(AVEH) + 1
297 GO TO 13
298 36 OCARS(AVEH) = OCARS(AVEH) + 1
299 GD TO 13
300 40 IF(TYPET.NE.1) GO TO 41

```

```

301 DTCN(NSL) = DTCN(NSL) + DRCN
302 41 IF(TYPEB.NE.1)GO TO 42
303 DTCN(NSLB) = DTCN(NSLB) + DRCNB
304 42 IF(TYPER.NE.1)GO TO 43
305 DTCN(NSLR) = DTCN(NSLR) + ORCNR
306 43 IF(TYPEL.NE.1)GO TO 3
307 OTCN(NSLL) = DTCN(NSLL) + ORCNL
308 GO TO 3
309 100 PLACE = DET(PL,11)
310 TYPEB = BLANE(PLACE,2)
311 OECB = BLANE(PLACE,1)
312 IF(TYPEB.EQ.1) GD TO 103
313 VQUEB = OET(OECB,6)
314 TEMP1 = DET(DECB,3)
315 TEMP2 = DET(DECB,12)
316 IF(TEMP2.EQ.1) GO TO 102
317 101 TEMP2 = OET(TEMP1,12)
318 TEMP1 = OET(TEMP1,3)
319 IF(TEMP2.NE.1) GO TO 101
320 102 NSLB = TEMP1
321 GO TO 104
322 103 VQUEB=JUN(OECB,24)
323 NSLB = OECB
324 104 TEMP = BLANE(PLACE,4)
325 NUMCRB = (BLANE(PLACE,3)*TEMP)/VLTH
326 IF (JUN(NSLB,12)) 65,65,66
327 65 IF (JUN(NSLB,13)) 67,67,66
328 67 IF (JUN(NSLB,14)) 68,68,66
329 66 NUMCRB = (NUMCRB + 1)/2
330 68 OEQUB = NUMCRB - VQUEB
331 GO TO 11
332 150 IF(CARS(AVEH,3).GT.0) GD TO 18
333 OEQUB = DEQUB - 1
334 51 IF (DEQUB.LT.0) GD TO 33
335 DRCNB = DRCNB + 1
336 VVEL = - CARS(AVEH,3)
337 J = BLANE(PLACE,3)/VVEL
338 K = ((BLANE(PLACE,3) - J*VVEL)*10000)/VVEL
339 RNS = GGUBFS(10000) + 1
340 IF(K.GT.RNS) J = J+1
341 CARS(AVEH,1) = J
342 X=2
343 IF(TYPEB.EQ.1)X=1
344 CALL SVEH(2,PL,AVEH,X,DECB)
345 MARK = 2
346 OECX=OECB
347 NSLX = NSLB
348 TYPEX = TYPEB
349 GO TO 23
350 200 PLACE = DET(PL,11)
351 TYPEL = MLANE(PLACE,2)
352 DECL = MLANE(PLACE,1)
353 TYPER = MLANE(PLACE,6)
354 OECR = MLANE(PLACE,5)
355 IF(TYPEL.EQ.1) GD TO 203
356 VQUEL = DET(OECL,6)
357 TEMP1 = DET(OECL,3)
358 TEMP2 = DET(OECL,12)
359 IF(TEMP2.EQ.1)GD TO 202
360 201 TEMP2 = DET(TEMP1,12)

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361      TEMP1 = DET(TEMP1,3)
362      IF(TEMP2.NE.1)GO TO 201
363      NSLL = TEMP1
364      GO TO 204
365      VOUEL = JUN(OECL,24)
366      NSSL = OECL
367      TEMP = MLANE(PLACE,4)
368      NUMCRL = (MLANE(PLACE,3)*TEMP)/VLTH
369      IF (JUN(NSLL,13)) 69,69,70
370      69 IF (JUN(NSLL,12)) 71,71,70
371      71 IF (JUN(NSLL,14)) 72,72,70
372      70 NUMCRL = (NUMCRL + 1)/2
373      DEOUL = NUMCRL - VOUEL
374      205 IF(TYPER.EQ.1)GO TO 208
375      VOUER = OET(DECLR,6)
376      TEMP1 = OET(DECLR,3)
377      TEMP2 = OET(DECLR,12)
378      IF(TEMP2.EQ.1) GO TO 207
379      206 TEMP2 = OET(TEMP1,12)
380      TEMP1 = OET(TEMP1,3)
381      IF(TEMP2.NE.1)GO TO 206
382      NSLR = TEMP1
383      GO TO 209
384      VOUER = JUN(DECLR,24)
385      NSLR = DECLR
386      TEMP = MLANE(PLACE,8)
387      NUMCRR = (MLANE(PLACE,7)*TEMP)/VLTH
388      IF (JUN(NSLR,14)) 73,73,74
389      73 IF (JUN(NSLR,12)) 75,75,74
390      75 IF (JUN(NSLR,13)) 76,76,74
391      74 NUMCRR = (NUMCRR + 1)/2
392      DEOUR = NUMCRR - VOUER
393      GO TO 11
394      250 IF(CARS(AVEH,2) - 2)18,251,253
395      251 IF(DECL.EQ.OECT.AND.TYPER.EQ.TYPE)GO TO 18
396      DEOUL = DEOUL - 1
397      52 IF (DEOUL.LT.O) GO TO 35
398      DRCNL = DRCNL + 1
399      VVEL = CARS(AVEH,3)
400      IF(VVEL.LE.O)VVEL = -VVEL
401      J = MLANE(PLACE,3)/VVEL
402      K = ((MLANE(PLACE,3)-J*VVEL)*10000)/VVEL
403      RNS = GGUBFS(10000) + 1
404      IF(K.GT.RNS) J = J+1
405      CARS(AVEH,1) = J
406      IF(CARS(AVEH,3).GT.O) GO TO 252
407      X=2
408      IF(TYPER.EQ.1)X=1
409      CALL SVEH(2,PL,AVEH,X,DECL)
410      252 MARK = 3
411      DECX=DECL
412      NSLX = NSLL
413      TYPEX = TYPEL
414      GO TO 23
415      253 IF(OECL.EQ.OECT.AND.TYPER.EQ.TYPE)GO TO 18
416      DEOUR = DEOUR - 1
417      53 IF (DEOUR.LT.O) GO TO 36
418      DRCNR = DRCNR + 1
419      VVEL = CARS(AVEH,3)
420      IF(VVEL.LT.O)VVEL = -VVEL

421      J = MLANE(PLACE,7)/VVEL
422      RNS = GGUBFS(10000) + 1
423      K = ((MLANE(PLACE,7) - J*VVEL)*10000)/VVEL
424      IF(K.GT.RNS) J = J + 1
425      CARS(AVEH,1) = J
426      IF(CARS(AVEH,3).GT.O) GO TO 254
427      X=2
428      IF(TYPER.EQ.1)X=1
429      CALL SVEH(2,PL,AVEH,X,DECL)
430      254 MARK = 4
431      OECX = OECL
432      NSLX = NSLR
433      TYPEX = TYPER
434      GO TO 23
435      320 CALL SVND(AVEH,PL)
436      IF(BM.EQ.O)GO TO 318
437      COUNT = COUNT - 1
438      BCDUNT=BCDUNT-1
439      GO TO 13
440      END
441      SUBROUTINE CMPN(JN,ICALL,NSKIP,CHDP)
442      IMPLICIT INTEGER(A-Z)
443      INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
444      INTEGER*4 JUN,DET,ENTRY,JST,EST,DST,CARS,DTCN,NSTDP,OUTOAT,COUT,
445      1MLANE,BLANE,LTH,VELD,DETINT,
446      2JNST,
447      3MIN,MAX,EXTT,MINGT,MAXGT,NST,DEMDT,EXTDET,DEM,NDST
448      4INTEGER*4 SVDMOT(28,4,2),SVEXTT(28),SVEXT(28,4,6),SVOEM(28,4),
449      1 SVMXGT(28),SVMAX(28,4),EXTRGN(28,4),EXGN(28,4)
450      REAL*8 TIM
451      DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
452      1JST(75),DST(120),EST(40),CARS(750,4),JTST(75),DTCN(75),
453      2OLY(75),NSTDP(75),OUTOAT(12,3),CDUT(5,2),
454      3SATN(3),COUN(5),OCN(3),
455      4TLST(28,23),JNST(28),CHANGE(28,2),
456      5MLANE(6,8),BLANE(6,4),LTH(75),VELD(75),DETINT(120),
457      6DUMJUN(4),MASTJN(4),
458      7MIN(28,4),MAX(28,4),EXTT(28),MINGT(28),MAXGT(28),NST(28,4),
459      8DEMOET(28,4,2),EXTOET(28,4,6),OEM(28,4),NST(28)
460      DIMENSION ICDMP(28),ICHDP(28),NNSKIP(28),IRUN(28),FST(28)
461      COMMON JUN,DET,DECTR,ENTRY,JST,DST,EST,CARS,MSEC,
462      1JTST,OTCN,DLY,NSTDP,OUTDAT,CDUT,NOUT,NPER,
463      2MLANE,BLANE,LTH,VELO,OETINT,BM,BUS
464      COMMON/CDM1/SATN,CDUN,OCN,VLTH,
465      1ENOT,RNGE,SPEED,NVEH,UCST,LCST,RN,OOELAY
466      COMMON/CDM2/TLST,JNST,CHANGE,HFACT,NDUM,OUNJUN,MASTJN,
467      1MIN,MAX,EXTT,MINGT,MAXGT,NST,DEMDT,EXTDET,DEM,NDST,NJN,EXT
468      COMMON /BLKCM/ SVDMOT,SVEXTT,SVEXT,SVMXGT,SVMAX,SVDEM,
469      1 EXTRGN,EXGN,SVEXT,ICOMP,ICHDP,NNSKIP,IRUN,FST
470      K=NDST(JN)
471      C ICALL = 1 IF THIS CALL IS TO SET UP COMPENSATION.
472      IF (ICALL) 1,1,2
473      C CHOP = 0 OR THE NUMBER OF THE CURTAILED STAGE.
474      2 IF (CHDP) 3,3,4
475      C IF CHDP = 0 REPLACE IT BY THE NEXT STAGE.
476      3 RST=TLST(JN,1)
477      CHOP=NST(JN,RST)
478      C IF CHOP AND NSKIP ARE BOTH ZERO NO COMPENSATION IS NEEDED.
479      IF (NSKIP) 10,10,7
480      S RETURN

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481      4 N5KIP=N5KIP+1
482      7 ICOMP(JN)=1
483      1CHOP(JN)=CHOP
484      CHOP=0
485      N5KIP(JN)=N5KIP
486 C INHIBIT CHOPPING OR SKIPPING OF ALL STAGES
487      00 8 ST=1,K
488      8 EXTRGN(JN,ST) = -EXGN(JN,ST)*EXGN(JN,ST)
489      1 NEWST=CHANGE(JN,1)
490 C START OF A NEW CYCLE?
491      IF (NEWST-FST(JN)) 5,9,5
492      9 IF (ICOMP(JN)) 10,10,11
493 C IF 50 15 THIS THE START OF THE COMPENSATION CYCLE OR THE START OF
494 C THE FOLLOWING CYCLE?
495 C
496 C COMPENSATION CYCLE FINISHED - ALLOW PRIORITY CALLS.
497      10 00 12 ST=1,K
498      12 EXTRGN(JN,ST)=0
499      RETURN
500 C SET UP EXTRA GREEN FOR THE COMPENSATED STAGES.
501      11 ICOMP(JN)=0
502      55T=1CHOP(JN)
503      SKIP=N5KIP(JN)
504      00 13 ST=1,5KIP
505      EXTRGN(JN,55T)=EXGN(JN,55T)
506      13 55T=N5T(JN,55T)
507 C RESET THE COUNTER.
508      IRUN(JN)=K
509      RETURN
510      END
511      SUBROUTINE TLIGHT
512      IMPLICIT INTEGER (A-Z)
513      INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
514      INTEGER*4 JUN,DET,ENTRY,JST,EST,OST,CARS,OTCN,N5STOP,OUTDAT,COUT,
515      1MLANE,BLANE,LTH,VELO,DETINT,
516      2JNST,LA5TST
517      REAL*8 TIM
518      DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
519      1JST(75),OST(120),EST(40),CARS(750,4),JTST(75),OTCN(75),
520      2OLY(75),N5STOP(75),OUTDAT(12,3),COUT(5,2),
521      3SATN(3),COUN(5),OCN(3),
522      4TLST(28,23),JNST(28),CHANGE(28,2),
523      5MLANE(6,6),BLANE(6,4),LTH(75),VELO(75),DETINT(120),
524      6DUMJUN(4),MA5TJN(4),LA5TST(28),
525      7MIN(28,4),MAX(28,4),EXTT(28),MINGT(28),MAXGT(28),N5T(28,4),
526      8DEMDT(28,4,2),EXTDET(28,4,6),DEM(28,4),NDST(28)
527      COMMON JUN,DET,DECTR,ENTRY,JST,OST,EST,CARS,MSEC,
528      1JTST,OTCN,OLY,N5STOP,OUTDAT,COUT,NOUT,NPER,
529      2MLANE,BLANE,LTH,VELO,DETINT,BM,BUS
530      COMMON/COM1/SATN,COUN,OCN,VLTH,
531      1ENOT,RNGE,SPEED,NVEH,UCST,LCST,RN,ODELAY
532      COMMON/COM2/TLST,JNST,CHANGE,HFACT,NDUM,DUMJUN,MA5TJN,
533      1MIN,MAX,EXTT,MINGT,MAXGT,N5T,DEMDT,EXTDET,DEM,NDST,NJN,EXT
534      1000 FORMAT('O','FAULT IN CH5T.MSEC=',G8,' R=',G5,' JN=',G5,' ST=',G5)
535      1001 FORMAT('O','FAULT IN CH5T.MSEC=',G8,' STR=',G5,' JN=',G5)
536      1002 FORMAT('O','FAULT IN CHRO.MSEC=',G8,' Z=',G8,' JN=',G5,' ST=',
537      1G5,' STR=',G5)
538      1003 FORMAT('O','FAULT IN CHRO. R=',G8)
539      1004 FORMAT('O','FAULT IN CH5T. MSEC=',G8,' STR=',G5,' CH5=',G5,
540      1' JN=',G5)

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541 C -----
542 C -----
543      IF(NDUM.EQ.0)GO TO 444
544      00 44 I=1,NDUM
545      DUM=DUMJUN(I)
546      MA5T=MA5TJN(I)
547      CHANGE(DUM,1)=CHANGE(MA5T,1)
548      44 CONTINUE
549 C -----
550      444 P=COUN(4)
551      00 41 JN=1,P
552      IF(CHANGE(JN,1).EQ.0)GO TO 41
553      IF(TLST(JN,3).NE.0)GO TO 41
554      TLST(JN,3)=CHANGE(JN,1)
555      TLST(JN,2)=-HFACT
556      41 CONTINUE
557 C START OF CHANGE STAGE ROUTINE ( CH5T )
558      00 10 JN=1,P
559      IF(TLST(JN,3).EQ.0) GO TO 19
560      IF(TLST(JN,3).GT.0)GO TO 42
561      43 TLST(JN,3)=TLST(JN,3)+1000
562      IF(TLST(JN,3).LT.0) GO TO 10
563      STR = LASTST(JN)
564      ST=TLST(JN,3)
565      00 62 I=1,3,2
566      O = (ST*4-1) + 1
567      ARM = TLST(JN,O)
568      IF(ARM.EQ.0) GO TO 62
569      00 61 J = 1,3,2
570      OR = (STR*4-1) +J
571      ARMR = TLST(JN,OR)
572      IF(ARM.EQ.ARM) GO TO 63
573      61 CONTINUE
574      62 CONTINUE
575      STR = TLST(JN,3)
576      IF((STR.GT.4).OR.(STR.LT.1)) GO TO 18
577      CH5 = -TLST(JN,1)
578      IF(STR.NE.CH5) GO TO 919
579      905 00 9 I=1,3,2
580      R = 0
581      O = (STR*4 - 1) + 1
582      ARM = TLST(JN,O)
583      IF(ARM.EQ.0) GO TO 9
584      LN = TLST(JN,O+1)
585      IF((LN.EQ.1).OR.(LN.EQ.3).OR.(LN.EQ.5).OR.(LN.EQ.7)) GO TO 11
586      6 IF((LN.EQ.2).OR.(LN.EQ.3).OR.(LN.EQ.6).OR.(LN.EQ.7)) GO TO 12
587      7 IF((LN.GE.4).AND.(LN.LE.7)) GO TO 13
588      8 IF(R.GT.0) GO TO 17
589      9 CONTINUE
590      TLST(JN,1) = -TLST(JN,1)
591      TLST(JN,2) = 1
592      TLST(JN,3) = 0
593      10 CONTINUE
594      RETURN
595      11 SIG1 = JUN(ARM,12)
596      IF(SIG1.GE.0) GO TO 14
597      JUN(ARM,12) = -JUN(ARM,12)
598      GO TO 6
599      12 SIG2 = JUN(ARM,13)
600      IF(SIG2.GE.0) GO TO 15

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601      JUN(ARM,13) = -JUN(ARM,13)
602      GO TO 7
603      13 SIG3 = JUN(ARM,14)
604      IF(SIG3.GE.0) GO TO 16
605      JUN(ARM,14) = -JUN(ARM,14)
606      GO TO 8
607      14 R = 1
608      GO TO 6
609      15 R = 10
610      GO TO 7
611      16 R = 100
612      17 WRITE(6,1000) MSEC,R,JN,STR
613      GO TO 9
614      18 WRITE(6,1001) MSEC,STR,JN
615      TEST = STR/10
616      NEWST = STR-10*TEST
617      STR = NEWST
618      GO TO 905
619      19 TLST(JN,2) = TLST(JN,2) + 1
620      GO TO 10
621      919 WRITE(6,1004) MSEC,STR,CHS,JN
622      GO TO 905
623      C -----
624      C -----
625      42 TLST(JN,2)=TLST(JN,2)+1
626      IF (TLST(JN,2)) 10,10,2
627      2 ST=TLST(JN,3)
628      C START OF CHANGE STAGE REQUEST ROUTINE ( CHRO )
629      20 Z = 0
630      IF((ST.GT.4).OR.(ST.LT.1)) Z = 1
631      IF((JN.GT.COUN(4)).OR.(JN.LT.1)) Z = Z + 10
632      IF(TLST(JN,1).LE.0)Z=Z+100
633      IF(Z.GT.0) GO TO 26
634      STR = TLST(JN,1)
635      IF(STR.EQ.ST)GO TO 24
636      00 24 I=1,3,2
637      R = 0
638      Q = (STR*4 - 1) + 1
639      ARM = TLST(JN,Q)
640      IF(ARM.EQ.0) GO TO 24
641      IMARK = 1
642      JMARK = DECTR(ARM)
643      DECTR(ARM) = LOR(IMARK,JMARK)
644      LN = TLST(JN,Q+1)
645      IF((LN.EQ.1).OR.(LN.EQ.3).OR.(LN.EQ.5).OR.(LN.EQ.7)) GO TO 27
646      21 IF((LN.EQ.2).OR.(LN.EQ.3).OR.(LN.EQ.6).OR.(LN.EQ.7)) GO TO 28
647      22 IF((LN.GE.4).AND.(LN.LE.7)) GO TO 29
648      23 IF(R.GT.0) GO TO 33
649      24 CONTINUE
650      00 52 I=1,3,2
651      O = (ST*4 -1) + I
652      ARM = TLST(JN,O)
653      IF(ARM.EQ.0) GO TO 52
654      00 51 J = 1,3,2
655      OR = (STR*4-1) + J
656      ARMR = TLST(JN,OR)
657      IF(ARM.EQ.ARM) GO TO 53
658      51 CONTINUE
659      52 CONTINUE
660      LASTST(JN) = STR

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661      924 TLST(JN,1) = -ST
662      TLST(JN,2) = 0
663      INTG = TLST(JN,ST+19)
664      IF(INTG.EQ.0) GO TO 926
665      TLST(JN,3) = ST - INTG*1000
666      GO TO 43
667      53 IMARK = 1
668      JMARK = 2
669      KMARK = 4
670      LN=TLST(JN,Q+1)
671      LNR=TLST(JN,OR+1)
672      LNO = LAND(LN,LNR)
673      LNL = LAND (IMARK,LNO)
674      IF(LNL.EQ.0) GO TO 54
675      JUN(ARM,12) = -JUN(ARM,12)
676      54 LNL = LAND(JMARK,LNO)
677      IF(LNL.EQ.0) GO TO 55
678      JUN(ARM,13) = -JUN(ARM,13)
679      55 LNL = LAND(KMARK,LNO)
680      IF(LNL.EQ.0) GO TO 56
681      JUN(ARM,14) = -JUN(ARM,14)
682      56 GO TO 51
683      63 IMARK=1
684      JMARK=2
685      KMARK=4
686      LN=TLST(JN,Q+1)
687      LNR=TLST(JN,OR+1)
688      LNO = LAND(LN,LNR)
689      LNL = LAND(LNO,IMARK)
690      IF(LNL.EQ.0) GO TO 64
691      JUN(ARM,12) = -JUN(ARM,12)
692      64 LNL = LAND(JMARK,LNO)
693      IF(LNL.EQ.0) GO TO 65
694      JUN(ARM,13) = -JUN(ARM,13)
695      65 LNL = LAND(KMARK,LNO)
696      IF(LNL.EQ.0) GO TO 66
697      JUN(ARM,14) = -JUN(ARM,14)
698      66 GO TO 61
699      25 Z = Z+ 1000
700      26 WRITE(6,1002) MSEC,Z,JN,ST,TLST(JN,1)
701      GO TO 24
702      926 TLST(JN,3) = ST-1000
703      GO TO 43
704      27 SIG1 = JUN(ARM,12)
705      IF(SIG1.LE.0) GO TO 30
706      JUN(ARM,12) = -JUN(ARM,12)
707      GO TO 21
708      28 SIG2 = JUN(ARM,13)
709      IF(SIG2.LE.0) GO TO 31
710      JUN(ARM,13) = -JUN(ARM,13)
711      GO TO 22
712      29 SIG3 = JUN(ARM,14)
713      IF(SIG3.LE.0) GO TO 32
714      JUN(ARM,14) = -JUN(ARM,14)
715      GO TO 23
716      30 R = 1
717      GO TO 21
718      31 R = R + 10
719      GO TO 22
720      32 R = R + 100

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721      33 WRITE(6,1003) R
722      GO TO 26
723      C -----
724      END
725      SUBROUTINE EMW01
726      C ENTRY AND EXIT DECISION ROUTINES
727      IMPLICIT INTEGER (A-Z)
728      INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
729      REAL R0
730      INTEGER*4 JUN,DET,ENTRY,JST,EST,OST,CARS,OTCN,NSTOP,OUTOAT,COUT,
731      1MLANE,BLANE,LTH,VELO,DETINT
732      REAL*8 TIM
733      DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
734      1JST(75),OST(120),EST(40),CARS(750,4),JTST(75),OTCN(75),
735      2OLY(75),NSTOP(75),OUTOAT(12,3),COUT(5,2),
736      3SATN(3),COUN(5),OCN(3),
737      4MLANE(6,8),BLANE(6,4),LTH(75),VELO(75),DETINT(120)
738      COMMON JUN,DET,DECTR,ENTRY,JST,OST,EST,CARS,MSEC,
739      1JTST,OTCN,OLY,NSTOP,OUTOAT,COUT,NOUT,NPER,
740      2MLANE,BLANE,LTH,VELO,DETINT,BM,BUS
741      COMMON/COM1/SATN,COUN,OCN,VLTH,
742      1ENOT,RNGE,SPEED,NVEH,UCST,LCST,RN,ODELAY
743      COMMON /BLK1/ NSTRT(40),SUMN(40),SNSO(40),TNSTRT(40),TSUMN(40)
744      1,TSNSO(40),NM(40)
745      1005 FORMAT(' ',T20,' UCST IS EMPTY ')
746      19 PL=0
747      MMSEC = MSEC - 60*(MSEC/60)
748      20 PL=PL+1
749      GO TO 301
750      21 IF(PL.EQ.COUN(3)) GO TO 22
751      GO TO 20
752      22 RETURN
753      C IF EXIT POINT GO TO 21
754      301 IF(ENTRY(PL,4).EQ.0) GO TO 21
755      C EXTRACT ENTRY POINT DATA
756      PCAR=ENTRY(PL,3)
757      ANLK=ENTRY(PL,4)
758      TIMEN = ENTRY(PL,5)
759      C -----
760      C CALCULATE NUMBER OF CARS TO RELEASE
761      COUNT = 0
762      302 IF(PCAR.LT.5000) GO TO 303
763      PCAR = PCAR - 5000
764      IF(MSEC.EQ.1)R=RN
765      R=R*803
766      R0=0.5+FLOAT(R)*.2328306E-9
767      RNS=10000*R0+1
768      IF(RNS.GT.5000) GO TO 302
769      COUNT = COUNT + 1
770      GO TO 302
771      303 IF(MSEC.EQ.1)R=RN
772      R=R*803
773      R0=0.5+FLOAT(R)*.2328306E-9
774      RNS=10000*R0+1
775      IF(RNS.GT.PCAR) GO TO 304
776      COUNT = COUNT + 1
777      C INCREMENT STORES FOR I EVERY MINUTE.
778      304 NM(PL) = NM(PL) + COUNT
779      IF (MMSEC) 3,2,3
780      2 NSTRT(PL) = NSTRT(PL) + 1

781      SUMN(PL) = SUMN(PL) + NM(PL)
782      SNSO(PL) = SNSO(PL) + NM(PL)*NM(PL)
783      NM(PL) = 0
784      C -----
785      C STORE VEHICLES IN DETECTOR DECISION LIST
786      3 IF (COUNT.EQ.0) GO TO 21
787      COUNT = COUNT - 1
788      ENTRY(PL,6) = ENTRY(PL,6) + 1
789      AVEH=UCST
790      UCST=CARS(AVEH,4)
791      IF(UCST.EQ.0) GO TO 310
792      IF(UCST-LCST) 9304,9304,8304
793      8304 LCST = UCST
794      9304 RNS = GGUBFS(10000) + 1
795      IF(RNS.LE.DET(ANLK,8)) GO TO 215
796      K = DET(ANLK,8) + DET(ANLK,9)
797      IF(RNS.LE.K) GO TO 216
798      CARS(AVEH,2) = 1
799      9305 CARS(AVEH,1) = TIMEN
800      CARS(AVEH,3)=SPEED
801      CARS(AVEH,4)=0
802      NCAR=DET(ANLK,2)
803      IF(NCAR.EQ.0) GO TO 311
804      CARS(NCAR,4)=AVEH
805      305 DET(ANLK,2)=AVEH
806      DET(ANLK,6) = DET(ANLK,6) + 1
807      CARS(AVEH,4)=0
808      GO TO 3
809      306 DET(ANLK,1)=AVEH
810      GO TO 305
811      215 CARS(AVEH,2) = 2
812      GO TO 9305
813      216 CARS(AVEH,2) = 3
814      GO TO 9305
815      C -----
816      C CAR STORE EMPTY, DUMP CORE
817      310 UCST=AVEH
818      WRITE(6,1005)
819      C ENTER ENOJOB SUBROUTINE TO TERMINATE THIS RUN
820      CALL ENDP
821      311 DET(ANLK,1) = AVEH
822      GO TO 305
823      END
824      SUBROUTINE JMW01
825      C JUNCTION DECISION ROUTINE
826      IMPLICIT INTEGER(A-Z)
827      INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
828      INTEGER*4 JUN,DET,ENTRY,JST,EST,OST,CARS,OTCN,NSTOP,OUTOAT,COUT,
829      1MLANE,BLANE,LTH,VELO,DETINT,OTMP(3),
830      3MIN,MAX,EXTT,MINGT,MAXGT,NST,DEMOET,EXTDET,DEM,NOST,OCARS,HIST
831      REAL*8 TIM
832      DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
833      1JST(75),OST(120),EST(40),CARS(750,4),JTST(75),OTCN(75),
834      2OLY(75),NSTOP(75),OUTOAT(12,3),COUT(5,2),
835      3SATN(3),COUN(5),OCN(3),
836      4TLST(28,23),TIMING(28,6),CTIME(6),TIME(6),JNST(28),CHANGE(28,2),
837      5MLANE(6,8),BLANE(6,4),LTH(75),VELO(75),DETINT(120),
838      6DUMJUN(4),MASTJN(4),
839      7MIN(28,4),MAX(28,4),EXTT(28),MINGT(28),MAXGT(28),NST(28,4),
840      8DEMOET(28,4,2),EXTDET(28,4,6),DEM(28,4),NOST(28)

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841      COMMON JUN,DET,DECTR,ENTRY,JST,OST,EST,CARS,MSEC,
842      1JST,OTCN,OLY,NSTOP,OUTOAT,COUT,NOUT,NPER,
843      2MLANE,BLANE,LTH,VELO,DETINT,BM,BUS
844      COMMON/COM1/SATN,COUN,OCN,VLTH,
845      1ENOT,RNGE,SPEED,NVEH,UCST,LCST,RN,QOELAY
846      COMMON/COM2/TLST,JNST,CHANGE,HFACT,NOUM,DUMJUN,MASTJN,
847      1MIN,MAX,EXTT,MINGT,MAXGT,NST,DEMOET,EXTOET,DEM,NOST,NJN,EXT
848      COMMON /BLKHST/ OCARS(750),HIST(75,20),HSTINC
849      1000 FORMAT(' ','LINK SATURATED FOR ',G2,' CYCLES AT JUNCTION STOPLINE
850      1 ',G6)
851      1001 FORMAT(' ',T20,G6,' VEHICLES LEFT AT END OF GREEN')
852      13 PL=0
853      14 PL=PL+1
854      GO TO 101
855      15 IF(PL.EQ.COUN(1)) GO TO 16
856      GO TO 14
857      16 RETURN
858      23 A1 = 0
859      A2 = 1
860      A1 = A2/A1
861      CALL EXIT
862      GO TO 16
863      C      CLEAR STORES
864      101 FVEH=0
865      LVEH=0
866      MARK = 0
867      CCNP=0
868      VREQ=0
869      DEQU=0
870      TEMP=0
871      RT3 = 0
872      DO 102 J = 1,3
873      OCN(J)=0
874      SATN(J)=0
875      QTMP(J) = 0
876      102 CONTINUE
877      C      -----
878      AVEH=JUN(PL,1)
879      C      IF NO VEHICLES IN LIST GO TO 137
880      IF (AVEH) 310,310,2000
881      C      INCREMENT SATURATION FLOW CARRY IF THE LIGHTS ARE GREEN
882      310 DO 300 J=1,3
883      IF (JUN(PL,J+1)) 300,300,305
884      305 TTT = JUN(PL,J+5)
885      IF (TTT) 300,300,301
886      301 ITTT = JUN(PL,J+8) + TTT
887      IF (ITTT-100) 304,300,300
888      304 JUN(PL,J+8) = ITTT
889      GO TO 300
890      300 CONTINUE
891      GO TO 137
892      C      -----
893      C      COUNT NUMBER OF ARMS SHOWING RED
894      2000 J = 0
895      DO 2001 I = 1,3
896      K = JUN(PL,I+11)
897      IF(K.GT.0) GO TO 2001
898      J = J + 1
899      2001 CONTINUE
900      C      -----

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901      C      IF ALL ARMS ARE RED GO TO 150
902      IF(J.EQ.3) GO TO 150
903      C      SOME ARMS GREEN
904      JUN(PL,27) = 0
905      M1 = 0
906      M2 = 0
907      M3 = 0
908      C      -----
909      C      COUNT CARS READY TO BE PROCESSED FOR EACH ARM AND STORE IN OCN
910      103 IF(AVEH.EQ.0) GO TO 106
911      C      M1 COUNTS TOTAL NUMBER OF CARS IN LIST
912      M1 = M1 + 1
913      CARS(AVEH,1)=CARS(AVEH,1)-1
914      IF(CARS(AVEH,1).LE.0) GO TO 105
915      104 AVEH=CARS(AVEH,4)
916      GO TO 103
917      105 K = CARS(AVEH,2)
918      C      M2 COUNTS TOTAL NO. OF CARS TO BE PROCESSED
919      9105 M2 = M2 + 1
920      C      OCN COUNTS CARS TO PROCESS FOR EACH DIRECTION
921      OCARS(AVEH) = OCARS(AVEH) + 1
922      OCN(K) = OCN(K) + 1
923      IF((CARS(AVEH,1)+1).EQ.0) NSTOP(PL)=NSTOP(PL) + 1
924      GO TO 104
925      C      -----
926      C      CALCULATE VEHICLES TO BE RELEASED IF FLOW SATURATED
927      106 IF (M2.EQ.0) GO TO 180
928      AVEH = JUN(PL,1)
929      RT = OCN(3)
930      DO 112 J = 1,3
931      SATN(J) = JUN(PL,J+5)
932      IF(SATN(J).GE.0) GO TO 108
933      TEMP = -SATN(J)
934      OCN(TEMP) = OCN(TEMP) + OCN(J)
935      OCN(J)=SATN(J)
936      GO TO 112
937      108 TEMP=0
938      109 JUN(PL,J+8) = JUN(PL,J+8) + SATN(J)
939      110 IF((JUN(PL,J+8) - 100).LT.0) GO TO 111
940      JUN(PL,J+8) = JUN(PL,J+8) - 100
941      TEMP = TEMP + 1
942      QTMP(J) = 1
943      GO TO 110
944      111 SATN(J)=TEMP
945      112 CONTINUE
946      C      -----
947      C      CALCULATE NUMBER OF VEHICLES TO BE RELEASED THIS SECOND
948      114 DO 116 J=1,3
949      IF(OCN(J).LT.0) GO TO 116
950      IF (OCN(J).GE.SATN(J)) GO TO 9116
951      C      IF THERE ARE LESS VEHICLES IN A GIVEN DIRECTION THAN
952      C      COULD BE RELEASED SET THE SATURATION FLOW CARRY TO 100
953      C      FOR THAT DIRECTION.
954      JUN(PL,J+8) = 100
955      C      M3 COUNTS CARS TO BE RELEASED
956      9114 M3 = M3 + OCN(J)
957      GO TO 116
958      9116 OCN(J) = SATN(J)
959      C      M3 COUNTS CARS TO BE RELEASED
960      M3 = M3 + OCN(J)

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961      116 CONTINUE
962      C      M1 = CDUNT OF CARS LEFT IN LIST
963      M1 = M1 - M3
964      C      M2 = COUNT OF CARS LEFT IN LIST WITH TIMERS EXPIRED
965      M2 = M2 - M3
966      C      SEE WHETHER THE DOWNSTREAM TRAFFIC LIGHTS ARE GREEN.
967      C      IF SO VGRN = 2 TO DOUBLE THE VEHICLE LENGTH.
968      IF (M3) 145,145,400
969      400 00 401 IJ = 1,3
970      ANLK = JUN(PL,IJ+2)
971      IF (ANLK) 401,401,402
972      402 TEMP = DET(ANLK,12)
973      ANLK = DET(ANLK,3)
974      IF(TEMP - 1) 402,404,402
975      404 00 405 IK = 1,3
976      IF (JUN(ANLK,IK+1)) 405,405,406
977      405 CONTINUE
978      401 CONTINUE
979      VGRN = 1
980      GO TO 403
981      406 VGRN = 2
982      GO TO 403
983      -----
984      C      START OF MAIN JUNCTION ROUTINE
985      C      IF NO VEHICLES TO BE RELEASED GO TO 145
986      117 IF(M3.LE.0) GO TO 145
987      403 DIRN = CARS(AVEH,2)
988      LANES = JUN(PL,DIRN+11)
989      C      IF LIGHTS RED GO TO 136
990      IF(LANES.LT.0) GO TO 136
991      C      LIGHTS GREEN
992      C      CAN ANY VEHICLES BE RELEASED
993      IF(QCN(DIRN).LT.0) GO TO 126
994      TEMP = DIRN
995      GO TO 127
996      126 TEMP = -QCN(DIRN)
997      127 IF((QCN(TEMP).EQ.0).OR.(CARS(AVEH,1).GT.0)) GO TO 131
998      QCN(TEMP) = QCN(TEMP) - 1
999      -----
1000     C      EXTRACT DATA FOR VEHICLE TO BE RELEASED
1001     118 VEL = JUN(PL,DIRN+14)
1002     DIST = JUN(PL,DIRN+17)
1003     ANLK = JUN(PL,DIRN+2)
1004     IF((RT3.NE.3).AND.(DIRN.EQ.3)) GO TO 161
1005     C      SWITCH ACCORDING TO WHETHER NEXT LINK IS EXIT POINT,DUMMY EXIT
1006     C      POINT OR DETECTOR
1007     119 IF(ANLK) 139,155,120
1008     120 DEQU = DIST*LANES - VGRN*(VLTH*DET(ANLK,6))-VLTH
1009     C      IS THERE ROOM TO PASS THIS VEHICLE TO THE NEXT LINK
1010     C      IF NOT GO TO 136 AND TREAT AS IF LIGHT RED
1011     IF(DEQU.LT.0) GO TO 8136
1012     M3 = M3 - 1
1013     IF(DIRN - 2) 2120,122,1120
1014     1120 IF(JUN(PL,22).LT.1000) GO TO 122
1015     JUN(PL,22) = JUN(PL,22) - 1000
1016     GO TO 122
1017     2120 IF(JUN(PL,22).GE.1000) GO TO 4120
1018     RT9 = JUN(PL,22)
1019     3120 IF(RT9.LT.100) GO TO 122
1020     JUN(PL,22) = JUN(PL,22) - 100
1021     GO TO 122
1022     4120 RT9 = JUN(PL,22) - 1000
1023     GO TO 3120
1024     -----
1025     C      CALCULATE VEHICLE VELOCITY
1026     122 RNS = GGUBFS(100) + 1
1027     VEL = VEL + (((VEL*RNGE)*(RNS-50))/5000)
1028     C      CALCULATE TIME UNTIL NEXT DECISION
1029     J = DIST/VEL
1030     K = ((DIST - J*VEL)*10000)/VEL
1031     RNS = GGUBFS(10000) + 1
1032     IF(K.GT.RNS) J = J + 1
1033     CARS(AVEH,1) = J
1034     C      IS THIS A SPECIAL VEHICLE
1035     IF(CARS(AVEH,3).LT.0) GO TO 128
1036     CARS(AVEH,3)=VEL
1037     -----
1038     C      CALCULATE DIRECTION FOR AN ORDINARY VEHICLE
1039     9210 RNS = GGUBFS(10000) + 1
1040     IF(RNS.LE.DET(ANLK,8)) GO TO 215
1041     K = DET(ANLK,8) + DET(ANLK,9)
1042     IF(RNS.LE.K) GO TO 216
1043     CARS(AVEH,2)=1
1044     GO TO 124
1045     215 CARS(AVEH,2)=2
1046     GO TO 124
1047     216 CARS(AVEH,2)=3
1048     -----
1049     C      STORE VEHICLE IN NEXT DECISION LIST
1050     124 TEMP1 = ANLK
1051     TEMP2 = DET(ANLK,10)
1052     DCARS(AVEH) = DCARS(AVEH) - 1
1053     DD 1 IHIST = 1,19
1054     IF (DCARS(AVEH) - IHIST*HSTINC) 2,1,1
1055     1 CONTINUE
1056     IHIST = 20
1057     2 HIST(PL,IHIST) = HIST(PL,IHIST) + 1
1058     DLY(PL) = DLY(PL) + DCARS(AVEH)
1059     DCARS(AVEH) = 0
1060     30 IF(TEMP2 - 7) 31,32,33
1061     31 TEMP2 = DET(TEMP1,12)
1062     TEMP1 = DET(TEMP1,3)
1063     IF(TEMP2.EQ.1)GO TO 36
1064     GO TO 30
1065     32 IF(CARS(AVEH,3).GT.0) GO TO 31
1066     TEMP3 = DET(TEMP1,11)
1067     TEMP2 = BLANE(TEMP3,2)
1068     TEMP1 = BLANE(TEMP3,1)
1069     IF(TEMP2.EQ.1)GO TO 36
1070     GO TO 30
1071     33 IF(CARS(AVEH,2)- 2) 31,34,35
1072     34 TEMP3 = DET(TEMP1,11)
1073     TEMP2 = MLANE(TEMP3,2)
1074     TEMP1 = MLANE(TEMP3,1)
1075     IF(TEMP2.EQ.1)GO TO 36
1076     GO TO 30
1077     35 TEMP3 = DET(TEMP1,11)
1078     TEMP2 = MLANE(TEMP3,6)
1079     TEMP1 = MLANE(TEMP3,5)
1080     IF(TEMP2.EQ.1)GO TO 36

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1081      GO TO 30
1082      36 NSL = TEMP1
1083      JTST(NSL) = JTST(NSL)+CARS(AVEH,1)
1084      C ADD 1 TO VEHICLE TIMER AS DETECTOR ROUTINE FOLLOWS.
1085      CARS(AVEH,1) = CARS(AVEH,1) + 1
1086      IF(DET(ANLK,2).EQ.0) GO TO 129
1087      NL CAR=DET(ANLK,2)
1088      DET(ANLK,2)=AVEH
1089      CARS(NL CAR,4)=AVEH
1090      9124 IF(RT3.EQ.3) GO TO 173
1091      IF(CARS(AVEH,4).EQ.0) GO TO 137
1092      125 NL CAR=CARS(AVEH,4)
1093      CARS(AVEH,4)=0
1094      AVEH=NL CAR
1095      GO TO 117
1096      C -----
1097      C -----
1098      C SPECIAL CAR SUBROUTINE CALL POINT
1099      126 CARS(AVEH,3) = -VEL
1100      CALL SVEH(1,PL,AVEH,2,ANLK)
1101      CALL SVH1(AVEH,ANLK)
1102      GO TO 124
1103      C -----
1104      C NO VEHICLES ON NEXT LINK
1105      129 DET(ANLK,1)=AVEH
1106      DET(ANLK,2)=AVEH
1107      GO TO 9124
1108      C -----
1109      C CARS NOT PROCESSED THIS SECOND
1110      131 CCNP=CCNP+1
1111      132 IF(RT3.EQ.3) GO TO 171
1112      IF(FVEH.EQ.0) GO TO 134
1113      C TAG THIS CAR ONTO THE ONE AHEAD
1114      CARS(LVEH,4) = AVEH
1115      133 LVEH = AVEH
1116      IF(CARS(AVEH,4).EQ.0) GO TO 137
1117      AVEH=CARS(AVEH,4)
1118      C ZERO LAST WORD IN CASE NEW AVEH IS TO BE TAKEN OUT OF QUEUE.
1119      CARS(LVEH,4) = 0
1120      GO TO 117
1121      C FIRST VEHICLES NOT PROCESSED
1122      134 FVEH=AVEH
1123      GO TO 133
1124      C -----
1125      C VEHICLE TRANSFER BLOCKED.
1126      C RESET SATURATION FLOW CARRY SO THAT SATURATION FLOW IS NOT
1127      C LOST.
1128      8136 IF (DIRN - 2) 2135,2210,1135
1129      1135 IF (OTMP(3)) 2205,2205,2207
1130      2207 JUN(PL,11) = 100
1131      2205 IF (JUN(PL,22).GE.1000) GO TO 9136
1132      JUN(PL,22) = JUN(PL,22) + 1000
1133      GO TO 9136
1134      2135 IF (OTMP(1)) 2202,2202,2203
1135      2203 JUN(PL,9) = 100
1136      2202 IF (JUN(PL,22).GE.1000) GO TO 4135
1137      RT8 = JUN(PL,22)
1138      3135 IF(RT8.GE.100) GO TO 9136
1139      JUN(PL,22) = JUN(PL,22) + 100
1140      GOTO 9136
1141
1141      4135 RT8 = JUN(PL,22) - 1000
1142      GO TO 3135
1143      C NO VEHICLE TRANSFER POSSIBLE IN THIS DIRECTION. CORRECT OCN VALUE
1144      2210 IF (OTMP(2)) 9136,9136,2201
1145      2201 JUN(PL,10) = 100
1146      9136 OCN(TEMP) = OCN(TEMP) + 1
1147      C LIGHTS RED
1148      136 IF(CARS(AVEH,1).GT.0) GO TO 131
1149      C INCREMENT COUNT OF CARS STOPPED ON RED
1150      VRED = VRED + 1
1151      GO TO 131
1152      C -----
1153      C SIGN OFF ROUTINE
1154      137 JUN(PL,1) = FVEH
1155      JUN(PL,2) = LVEH
1156      IF(JUN(PL,14).GE.0) GO TO 2002
1157      IMARK = 1
1158      JMARK = DECTR(PL)
1159      IF(LAND(IMARK,JMARK).EQ.1) GO TO 166
1160      2002 JUN(PL,24) = CCNP
1161      JUN(PL,25) = VRED
1162      IMARK = 1
1163      JMARK = DECTR(PL)
1164      IMARK = LAND(IMARK,JMARK)
1165      DECTR(PL) = LXOR(IMARK,JMARK)
1166      GO TO 15
1167      C -----
1168      C NEXT DECISION AN EXIT POINT
1169      139 ANLK=-ANLK
1170      M3 = M3 - 1
1171      IF(CARS(AVEH,3).LT.0) GO TO 142
1172      C FILL GAP IN JUNCTION QUEUE
1173      9139 NL CAR = CARS(AVEH,4)
1174      C ADD VEHICLE BACK ONTO FRONT OF UNUSED VEHICLE QUEUE
1175      CARS(AVEH,4) = UCST
1176      DCARS(AVEH) = DCARS(AVEH) - 1
1177      DO 3 IHIST = 1,19
1178      IF (DCARS(AVEH) - IHIST*HSTINC) 4,3,3
1179      3 CONTINUE
1180      IHIST = 20
1181      4 HIST(PL,IHIST) = HIST(PL,IHIST) + 1
1182      DLY(PL) = DLY(PL) + DCARS(AVEH)
1183      DCARS(AVEH) = 0
1184      ENTRY(ANLK,6) = ENTRY(ANLK,6) + 1
1185      UCST = AVEH
1186      IF(RT3.EQ.3) GO TO 179
1187      IF(NL CAR.EQ.0) GO TO 137
1188      AVEH = NL CAR
1189      GO TO 117
1190      C -----
1191      142 CARS(AVEH,1) = 0
1192      CALL SVEH(1,PL,AVEH,3,ANLK)
1193      CALL SVEH(3,ANLK,AVEH,3,ANLK)
1194      GO TO 9139
1195      C -----
1196      145 CCNP = M1
1197      IF(FVEH.EQ.0) GO TO 147
1198      CARS(LVEH,4) = AVEH
1199      146 LVEH = JUN(PL,2)
1200      GO TO 137

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1201      147 FVEH=AVEH
1202      GO TO 146
1203      C -----
1204      C LIGHTS RED ON ALL ARMS
1205      150 FVEH = AVEH
1206      LVEH = JUN(PL,2)
1207      151 CCNP = CCNP + 1
1208      CARS(AVEH,1) = CARS(AVEH,1) - 1
1209      IF(CARS(AVEH,1).GT.0) GO TO 153
1210      OCARS(AVEH) = OCARS(AVEH) + 1
1211      IF((CARS(AVEH,1)+1).EQ.0) NSTOP(PL) = NSTOP(PL) + 1
1212      152 VREQ = VREQ + 1
1213      153 AVEH = CARS(AVEH,4)
1214      IF(AVEH.NE.0) GO TO 151
1215      IF(JUN(PL,27).NE.0) GO TO 137
1216      C -----
1217      C FIRST SECOND OF ALL RED CHECK THAT LINK NOT SATURATED
1218      JUN(PL,27) = 3
1219      IF(VREQ.GT.JUN(PL,28)) GO TO 154
1220      IF(VREQ.EQ.JUN(PL,28)) GO TO 158
1221      9153 JUN(PL,26) = 0
1222      GO TO 137
1223      154 JUN(PL,26) = JUN(PL,26) + 1
1224      JUN(PL,28) = VREQ
1225      IF(JUN(PL,26).LE.5) GO TO 137
1226      WRITE(6,1000) JUN(PL,26),JST(PL)
1227      WRITE(6,1001) VREQ
1228      C ABANDON FACILITY FOR OVERSATURATED STOPLINES.CHANGE 100 IF REQ
1229      IF(JUN(PL,26).EQ.100) GO TO 23
1230      GO TO 137
1231      C -----
1232      155 ANLK=-40
1233      GO TO 139
1234      C -----
1235      158 IF(VREQ.GT.10) GO TO 154
1236      GO TO 9153
1237      C -----
1238      161 IF(RT3.EQ.1) GO TO 119
1239      IF(RT3.EQ.0) GO TO 162
1240      C RIGHT TURN BLOCKED
1241      OCN(TEMP) = OCN(TEMP) + 1
1242      IF (OTMP(3)) 131,131,2204
1243      C RESET SATURATION FLOW CARRY.
1244      2204 JUN(PL,11) = 100
1245      GO TO 131
1246      C -----
1247      C LOOK TO SEE WHETHER RIGHT TURNS ARE STOPPED
1248      162 RT1 = JUN(PL,21)
1249      RTOET = 0
1250      C IF NO OPPOSING STOPLINE GO TO 164
1251      IF(RT1.EQ.0) GO TO 164
1252      RT2 = JUN(RT1,12)
1253      C IF OPPOSING FLOW STOPPED GO TO 164
1254      IF(RT2.LE.0) GO TO 164
1255      RT2 = JUN(RT1,1)
1256      C IF NO VEHICLES AT OPPOSING STOPLINE GO TO 5164
1257      163 IF (RT2.EQ.0) GO TO 5164
1258      C DISREGARD OPPOSING LEFT TURNING VEHICLES
1259      IF(CARS(RT2,2).EQ.2)GO TO 165
1260      IF (CARS(RT2,1).GT.5) GO TO 164

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1261      IF(CARS(RT2,2).EQ.1) GO TO 1163
1262      IF(JUN(RT1,22).GT.1000) GO TO 165
1263      GO TO 3163
1264      1163 IF (JUN(RT1,22).GE.1000) GO TO 2163
1265      IF(JUN(RT1,22).GE.100) GO TO 165
1266      GO TO 3163
1267      2163 IF(JUN(RT1,22)-1000.GE.100) GO TO 165
1268      C RIGHT TURNERS BLOCKED
1269      3163 IF(RT3.EQ.3) GO TO 2002
1270      RT3 = 2
1271      OCN(TEMP) = OCN(TEMP) + 1
1272      IF (OTMP(3)) 131,131,2206
1273      C RESET SATURATION FLOW CARRY.
1274      2206 JUN(PL,11) = 100
1275      GO TO 131
1276      C RIGHT TURNERS NOT BLOCKED
1277      164 IF(RT3.EQ.3) GO TO 167
1278      RT3 = 1
1279      GO TO 119
1280      C LOOK AT NEXT CAR
1281      165 RT2 = CARS(RT2,4)
1282      GO TO 163
1283      C LOK AT THE FIRST TWO DETECTORS UPSTREAM FROM THE STOPLINE.
1284      S164 IF (RTOET - 1) 5001,5002,164
1285      5001 RT1 = JUN(RT1,30)
1286      C RT1 IS THE FIRST DETECTOR UPSTREAM FROM THE STOPLINE.
1287      RTOET = RTOET + 1
1288      RT2 = OET(RT1,1)
1289      C RT2 IS THE FIRST CAR ON DETECTOR RT1.
1290      GO TO 163
1291      5002 RTOET = RTOET + 1
1292      RT1 = OET(RT1,13)
1293      C RT1 IS NOW THE SECOND DETECTOR FROM THE STOPLINE.
1294      C IT IS FOUND BY LOOKING FOR THE FIRST DETECTOR UPSTREAM FROM
1295      C THE PREVIOUS DETECTOR.
1296      IF (RT1) 164,164,5003
1297      5003 RT2 = OET(RT1,1)
1298      C RT2 IS THE FIRST CAR ON DETECTOR RT1.
1299      GO TO 163
1300      C -----
1301      166 RT3 = 3
1302      AVEH = JUN(PL,1)
1303      JUN(PL,23) = 0
1304      7166 IF(CARS(AVEH,2).NE.3) GO TO 8166
1305      IF(CARS(AVEH,1).GT.1)GO TO 8166
1306      JUN(PL,23) = JUN(PL,23) + 1
1307      8166 AVEH = CARS(AVEH,4)
1308      IF(AVEH.NE.0) GO TO 7166
1309      IF(JUN(PL,23).EQ.0) GO TO 2002
1310      GO TO 162
1311      C -----
1312      C RELEASE VEHICLES IN RIGHT TURN BOX
1313      167 RT7 = JUN(PL,22)
1314      IF(RT7.GE.1000) GO TO 2167
1315      1167 IF(RT7.GE.100) GO TO 3167
1316      GO TO 4167
1317      2167 RT7 = RT7 - 1000
1318      GO TO 1167
1319      3167 RT7 = RT7 - 100
1320      4167 IF(JUN(PL,23).LT.RT7) GO TO 168

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1321      JUN(PL,23) = RT7
1322      RT6 = JUN(PL,23)
1323      JUN(PL,23) = 0
1324      CCNP = CCNP - RT6
1325      VRED = VRED - RT6
1326      OIRN = 3
1327      TEMP = 3
1328      SATN(3) = 1000
1329      RT4 = 0
1330      LANES = JUN(PL,14)
1331      IF(LANES.LT.0) LANES = -LANES
1332      AVEH = JUN(PL,1)
1333      169 IF(RT6.LE.0) GO TO 178
1334      170 IF(AVEH.EQ.0) GO TO 177
1335      C LOOK FOR CARS TURNING RIGHT WITH TIMERS EXPIRED
1336      IF((CARS(AVEH,2).EQ.3).AND.(CARS(AVEH,1).LE.0)) GO TO 172
1337      171 RT4 = AVEH
1338      C RT4 HOLDS LAST CAR NOT PROCESSED
1339      AVEH = CARS(AVEH,4)
1340      GO TO 170
1341      C RELEASE CAR
1342      172 RT6 = RT6 - 1
1343      GO TO 118
1344      C
1345      C RETURN POINT AFTER VEHICLES HAVE BEEN RELEASED
1346      173 RT5 = CARS(AVEH,4)
1347      CARS(AVEH,4) = 0
1348      174 IF(RT4.EQ.0) GO TO 176
1349      CARS(RT4,4) = RT5
1350      C CLDSE GAP BETWEEN LAST VEHICLE RT4 AND NEXT VEHICLE RT5
1351      175 AVEH = RT5
1352      GO TO 169
1353      C IF RT4 IS 0 THEN STORE NEXT CAR RT5 AS FIRST ON STOPLINE
1354      176 JUN(PL,1) = RT5
1355      GO TO 175
1356      C
1357      177 JUN(PL,2) = RT4
1358      C LAST VEHICLE IN QUEUE ENCOUNTERED
1359      IF(RT4.EQ.0) GO TO 2002
1360      CARS(RT4,4) = 0
1361      GO TO 2002
1362      C
1363      C ALL RIGHT TURNERS IN INTERSECTION RELEASED
1364      178 IF(AVEH.EQ.0) GO TO 177
1365      GO TO 2002
1366      C
1367      C RETURN POINT AFTER VEHICLES HAVE BEEN RELEASED AT EXIT POINT
1368      179 RT5 = NL CAR
1369      GO TO 174
1370      180 CCNP = M1
1371      FVEH = JUN(PL,1)
1372      LVEH = JUN(PL,2)
1373      DO 212 J=1,3
1374      TTT = JUN(PL,J+11)
1375      IF (TTT) 212,212,213
1376      213 TTT = JUN(PL,J+5)
1377      IF (TTT) 212,212,208
1378      208 ITTT = JUN(PL,J+8) + TTT
1379      IF (ITTT - 100) 209,212,212
1380      209 JUN(PL,J+8) = ITTT

1381      GO TO 212
1382      212 CONTINUE
1383      GO TO 137
1384      END
1385      C
1386      C
1387      SUBROUTINE SVACT(NDEMD)
1388      IMPLICIT INTEGER(A-Z)
1389      INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
1390      INTEGER*4 JUN, DET, ENTRY, JST, EST, DST, CARS, DTCN, NSTOP, OUTDAT, CDUT,
1391      1MLANE, BLANE, LTH, VELO, DETINT,
1392      2JNST, SVSTRT,
1393      3MIN, MAX, EXTT, MINGT, MAXGT, NST, DEMDET, EXTDET, DEM, NDST
1394      INTEGER*4 SVDMDET(28,4,2), SVEXTT(28), SVEXT(28,4,6), SVDEM(28,4),
1395      1SVMXGT(28), SVMAX(28,4), EXTRGN(28,4), EXGN(28,4)
1396      INTEGER*4 NGRN, NGREEN, GRNT, GREENT
1397      INTEGER*4 FRCCNG(28,4,4), NSVEX(28,4,4), NWGP, NWMX
1398      REAL*8 TIM
1399      DIMENSION JUN(75,30), DET(120,15), DECTR(75), ENTRY(40,6),
1400      1JST(75), DST(120), EST(40), CARS(750,4), JTST(75), DTCN(75),
1401      2DLY(75), NSTOP(75), OUTDAT(12,3), CDUT(S,2),
1402      3SATN(3), CDUN(S), OCN(3),
1403      4TLST(28,23), JNST(28), CHANGE(28,2),
1404      5MLANE(6,8), BLANE(6,4), LTH(75), VELO(75), DETINT(120),
1405      6DUMJUN(4), MASTJN(4),
1406      7MIN(28,4), MAX(28,4), EXTT(28), MINGT(28), MAXGT(28), NST(28,4),
1407      8DEMDT(28,4,2), EXTDET(28,4,6), DEM(28,4), NDST(28)
1408      DIMENSION ICDMP(28), ICHOP(28), NNSKIP(28), IRUN(28), FST(28)
1409      COMMON JUN, DET, DECTR, ENTRY, JST, DST, EST, CARS, MSEC,
1410      1JTST, DTCN, DLY, NSTOP, OUTDAT, CDUT, NOUT, NPER,
1411      2MLANE, BLANE, LTH, VELO, DETINT, BM, BUS
1412      COMMON/COM1/SATN, CDUN, OCN, VLTH,
1413      1ENOT, RNGE, SPEED, NVEH, UCST, LCST, RN, QDELAY
1414      COMMON/COM2/TLST, JNST, CHANGE, HFACT, NDUM, DUMJUN, MASTJN,
1415      1MIN, MAX, EXTT, MINGT, MAXGT, NST, DEMDET, EXTDET, DEM, NDST, NJN, EXT
1416      COMMON /BLKCMF/ SVDMDET, SVEXTT, SVEXT, SVMXGT, SVMAX, SVDEM,
1417      1 EXTRGN, EXGN, SVEXT, ICDMP, ICHOP, NNSKIP, IRUN, FST
1418      COMMON /BLKTIM/ PCHNGE(28), MNJN, NGRN(28,4), NGREEN(28,4), GRNT(28,4)
1419      1, GREENT(28,4)
1420      COMMON /BLKFCG/ FRCCNG, NSVEX, NWGP, NWMX
1421      COMMON /BLKSVH/ SVST(100,11), SVDL(100,5), NSPVEH, START,
1422      1 SVSTRT(100), IPRINT
1423      C NUMBER OF JUNCTIONS=NJN.
1424      SV=0
1425      C DO FOR ALL JUNCTIONS.
1426      DO 1 JN=1, NJN
1427      K=NDST(JN)
1428      C ND S.V. DEMANDS STORED IN QUIESCENT CYCLE.
1429      IF (EXTRGN(JN,1)) SO,49,50
1430      50 DO 51 ST=1,K
1431      51 SVDEM(JN,ST) = 0
1432      GO TO 46
1433      C LOOK FOR S.V. DEMANDS.
1434      49 IF (NDEMD - 2) 41,41,42
1435      42 DO 43 ST=1,K
1436      44 1=1, NDEMD
1437      D = SVEXT(JN,ST,1)
1438      IF (D) 44,44,45
1439      45 SV = 1
1440      DD = DETINT(D)/100

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1441      IF (DD) 44,44,47
1442      47 WRITE (6,103) MSEC,D5T(D)
1443      103 FDRMAT (' **** MSEC =',17,5X,'BUS DETECTED AT'
1444      1 , 'DETECTDR',15)
1445      SVDEM(JN,ST) = SVDEM(JN,ST) + DD
1446      44 CONTINUE
1447      43 CONTINUE
1448      GD TO 46
1449      41 DD 3 ST = 1,K
1450      DD 2 I=1,2
1451      D = 5VDMDT(JN,ST,1)
1452      IF (D) 2,2,4
1453      4 SV = 1
1454      DD =DETINT(D)/100
1455      C FDR PASSAGE S.V. DETECTDRS ADD NEXT LINE
1456      IF (DD-20) 5,2,2
1457      5 SVDEM(JN,ST) = SVDEM(JN,ST) + DD
1458      IF (DD) 2,2,40
1459      40 IF (IPRINT.EQ.0) WRITE (6,101) MSEC
1460      101 FDRMAT (' **** MSEC =',17,5X,'BUS DETECTED AT'
1461      1 , 'DEMAND DETECTDR')
1462      2 CONTINUE
1463      3 CONTINUE
1464      C ND EXTENSION5 SET IN THE TRUE INTERGREEN.
1465      46 IF (TLST(JN,2)) 1,53,52
1466      53 IF (TLST(JN,3)) 56,1,1
1467      56 AA = (TLST(JN,1) + TLST(JN,3))/1000 + HFACT
1468      IF (AA) 1,1,54
1469      54 RST = -TLST(JN,1)
1470      GD TO 55
1471      C RUNNING STAGE NUMBER.
1472      52 RST = TLST(JN,1)
1473      55 SVEXTT(JN)=SVEXTT(JN)-1
1474      C LDDK FDR S.V. EXTENSION5.
1475      DD 13 I=1,6
1476      D=SVEXTT(JN,RST,1)
1477      IF (D) 13,13,7
1478      7 SV=-1
1479      IF (DETINT(D)/100) 13,13,14
1480      14 SVEXTT(JN)=SVEXT
1481      GD TO 12
1482      13 CONTINUE
1483      C IF ND S.V. DETECTDRS GD TO NEXT JUNCTION.
1484      12 IF (SV) 48,6,48
1485      C IF IN MIN GREEN ND CHANGE
1486      48 IF (MINGT(JN)) 17,17,1
1487      C LDDK FDR S.V. EXTENSION5.
1488      17 IF(SVEXTT(JN)) 18,18,19
1489      C ZERD DEMAND DN RUNNING STAGE,THEN LDDK FDR S.V. DEMANDS
1490      18 SVDEM(JN,RST)=0
1491      DD 20 ST=1,K
1492      IF (SVDEM(JN,ST)) 20,20,21
1493      20 CONTINUE
1494      C ND S.V. EXTENSION DR DEMAND GD TO 6.
1495      GD TO 6
1496      C
1497      C PRDCESS SPECIAL VEHICLE EXTENSION.
1498      C
1499      C CHECK WHETHER CHANGE CALLED BY V.A. RDUTINE.
1500      19 IF (CHANGE(JN,1)) 1,1,23

1501      23 IF (MAXGT(JN)) 25,25,26
1502      C GAP CHANGE DVERRIDEN
1503      26 CHANGE(JN,1)=0
1504      CHANGE(JN,2)=0
1505      IF (IPRINT.EQ.0) WRITE (6,100) JNST(JN)
1506      IF (MSEC - START) 1,1,11
1507      11 NSVEX(JN,RST,2) = NSVEX(JN,RST,2) + 1
1508      IF (NWGP) 1,8,1
1509      8 NSVEX(JN,RST,1) = NSVEX(JN,RST,1) + 1
1510      NWGP = 1
1511      GD TO 1
1512      C MAX CHANGE SET AND/OR DECREMENT MAX TIMER
1513      25 IF (SVMXGT(JN)) 28,28,29
1514      28 SVMXGT(JN)=SVMAX(JN,RST)+1
1515      29 SVMXGT(JN)=SVMXGT(JN)-1
1516      IF (SVMXGT(JN)) 30,30,31
1517      C DVERRIDE V.A. MAX CHANGE AND FDRCE V.A. RDUTINE TO CALL FDR MAX
1518      C CHANGE AGAIN NEXT SECDND.
1519      31 CHANGE(JN,1)=0
1520      CHANGE(JN,2)=0
1521      IF (IPRINT.EQ.0) WRITE (6,100) JNST(JN)
1522      MAXGT(JN)=1
1523      IF (MSEC - START) 1,1,15
1524      15 NSVEX(JN,RST,4) = NSVEX(JN,RST,4) + 1
1525      IF (NWMX) 1,10,1
1526      10 NSVEX(JN,RST,3) = NSVEX(JN,RST,3) + 1
1527      NWMX = 1
1528      GD TO 1
1529      30 SVEXTT(JN)=0
1530      CHANGE(JN,2) = 3
1531      SVMXGT(JN)=0
1532      DEM(JN,RST)=1
1533      D=5VDMDT(JN,RST,1)+5VDMDT(JN,RST,2)
1534      C PUT IN S.V. DEMAND IF ALLDWD DN THIS STAGE.
1535      IF (D) 36,36,33
1536      33 SVDEM(JN,RST)=1
1537      IF (IPRINT) 36,60,36
1538      60 WRITE (6,102) MSEC,JNST(JN),CHANGE(JN,2),CHANGE(JN,1)
1539      36 DD 34 ST=1,K
1540      IF (ST-RST) 35,34,35
1541      35 IF (SVDEM(JN,ST)) 34,34,21
1542      34 CONTINUE
1543      32 CALL CMPN(JN,0,0,0)
1544      MAXGT(JN)=0
1545      SVMXGT(JN)=0
1546      SVEXTT(JN)=0
1547      RST19 = RST + 19
1548      GREENT(JN,RST) = GREENT(JN,RST)+MSEC-PCHNGE(JN)-TLST(JN,RST19)
1549      NGREEN(JN,RST) =NGREEN(JN,RST) + 1
1550      PCHNGE(JN) = MSEC
1551      NWGP = 0
1552      NWMX = 0
1553      GD TO 1
1554      6 IF (CHANGE(JN,1)) 1,1,9
1555      C IF MAX GREEN CALLED PUT IN DEMAND.
1556      9 IF (MAXGT(JN)) 24,24,27
1557      24 DEM(JN,RST)=1
1558      MAXGT(JN)=0
1559      GD TO 32
1560      C DOTHERWISE ZERD DEMAND.

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1561 27 DEM(JN,RST)=0
1562 MAXGT(JN)=0
1563 GO TO 32
1564 21 CALL SVPOEM(JN)
1565 IF (CHANGE(JN,2) - 3) 37,38,37
1566 38 WRITE (6,102) MSEC,JNST(JN),CHANGE(JN,2),CHANGE(JN,1)
1567 37 SVMXGT(JN) = 0
1568 SVEXTT(JN)=0
1569 1 CONTINUE
1570 RETURN
1571 100 FDRMAT (TSO,' JUNCTIDN',13,' V.A. CHANGE DVERRIDEN BY '
1572 1 'S.V. EXTENSION')
1573 102 FDRMAT (' MSEC =',15,' JUNCTION',13,' CHANGE',12,
1574 1 ' OCCURING STAGE',12)
1575 END
1576 C
1577 C
1578 C
1579 SUBROUTINE SVPDEM(JN)
1580 IMPLICIT INTEGER(A-Z)
1581 INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
1582 INTEGER*4 JUN,DET,ENTRY,JST,EST,DST,CARS,OTCN,NSTDP,DUTDAT,CDUT,
1583 1MLANE,BLANE,LTH,VELD,DETINT,
1584 2JNST,SVSTRT,
1585 3MIN,MAX,EXTT,MINGT,MAXGT,NST,DEMDET,EXTDET,OEM,NOST
1586 INTEGER*4 SVOMDT(28,4,2),SVEXTT(28),SVEXDT(28,4,6),SVDEM(28,4),
1587 1SVMXGT(28),SVMAX(28,4),EXTRGN(28,4),EXGN(28,4)
1588 INTEGER*4 NGRN(28,4),NGREEN(28,4),GRNT(28,4),GREENT(28,4)
1589 REAL*8 TIM
1590 INTEGER*4 FRCCNG(28,4,4),NSVEX(28,4,4),NWGP,NWMX
1591 DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
1592 1JST(75),OST(120),EST(40),CARS(750,4),JTST(75),OTCN(75),
1593 2DLY(75),NSTDP(75),DUTOAT(12,3),CDUT(5,2),
1594 3SATN(3),COUN(5),OCN(3),
1595 4TLST(28,23),JNST(28),CHANGE(28,2),
1596 5MLANE(6,8),BLANE(6,4),LTH(75),VELO(75),DETINT(120),
1597 6DUMJUN(4),MASTJN(4),
1598 7MIN(28,4),MAX(28,4),EXTT(28),MINGT(28),MAXGT(28),NST(28,4),
1599 8DEMDET(28,4,2),EXTDET(28,4,6),OEM(28,4),NDST(28)
1600 DIMENSION 1CDMP(28),1CHDP(28),NNSKIP(28),IRUN(28),FST(28)
1601 CDMMDN JUN,DET,DECTR,ENTRY,JST,OST,EST,CARS,MSEC,
1602 1JTST,OTCN,DLY,NSTOP,DUTOAT,CDUT,NOUT,NPER,
1603 2MLANE,BLANE,LTH,VELD,DETINT,BM,BUS
1604 CDMMDN/CDM1/SATN,CDUN,OCN,VLTH,
1605 1ENDT,RNGE,SPEED,NVEH,UCST,LCST,RN,QDELAY
1606 CDMMDN/CDM2/TLST,JNST,CHANGE,HFACT,NDUM,DUMJUN,MASTJN,
1607 1MIN,MAX,EXTT,MINGT,MAXGT,NST,DEMDET,EXTDET,DEM,NDST,NJN,EXT
1608 CDMMDN /BLKCMF/ SVOMDT,SVEXTT,SVEXDT,SVMXGT,SVMAX,SVDEM,
1609 1 EXTRGN,EXGN,SVEXT,1CDMP,1CHDP,NNSKIP,IRUN,FST
1610 CDMMDN /BLKTIM/ PCHNGE(28),MNJN,NGRN,NGREEN,GRNT,GREENT
1611 CDMMDN /BLKFCG/ FRCCNG,NSVEX,NWGP,NWMX
1612 CDMMDN /BLKSVH/ SVST(100,11),SVDL(100,5),NSPVEH,START,
1613 1 SVSTRT(100),IPRINT
1614 C K=NUMBER OF STAGES AND RST=RUNNING STAGE.
1615 K=NDST(JN)
1616 RST=TLST(JN,1)
1617 NEWST=RST
1618 C FIND THE NEXT STAGE IN THE CYCLE WITH A PRIORITY CALL
1619 KK=K-1
1620 DD 2 SST=1, KK

1621 C CHECK WHETHER THIS STAGE IS BEING COMPENSATED.
1622 IF (EXTRGN(JN,NEWST)) 4,16,4
1623 16 NEWST=NST(JN,NEWST)
1624 C SEE IF THIS NEXT STAGE HAS BEEN CALLED BY AN S.V. DEMAND.
1625 IF (SVDEM(JN,NEWST)) 2,2,3
1626 2 CONTINUE
1627 C IF IN COMPENSATION CYCLE MAY STILL HAVE V.A. CHANGE.
1628 4 IF (CHANGE(JN,1)) 5,5,6
1629 C NO V.A. REQUEST-RETURN.
1630 5 RETURN
1631 C IF ONLY THE RUNNING STAGE IS LEFT IN THE COMPENSATION CYCLE AND A
1632 V.A. CHANGE HAS BEEN CALLED AN S.V. DEMAND IS ALLOWED - GO TO 16.
1633 6 FF = FST(JN)
1634 IF (NST(JN,RST)-FF) 15,1,15
1635 1 IF (EXTRGN(JN,FF)) 15,16,16
1636 C PUT IN V.A. DEMAND IF HAVE A MAX GREEN V.A. CHANGE.
1637 15 IF (MAXGT(JN)) 7,7,8
1638 8 DEM(JN,RST)=0
1639 MAXGT(JN)=0
1640 CALL CMPN(JN,0,0,0)
1641 11 NGREEN(JN,RST) = NGREEN(JN,RST) + 1
1642 RST19 = RST + 19
1643 GREENT(JN,RST) = GREENT(JN,RST)+MSEC-PCHNGE(JN)-TLST(JN,RST19)
1644 PCHNGE(JN) = MSEC
1645 NWGP = 0
1646 NWMX = 0
1647 RETURN
1648 7 OEM(JN,RST)=1
1649 MAXGT(JN)=0
1650 CALL CMPN(JN,0,0,0)
1651 GO TO 11
1652 C
1653 C REACH LABEL 3 IF NEWST HAS AN S.V. DEMAND AND IS ALLOWED BY COMPENSAT
1654 3 IF (CHANGE(JN,1)) 9,9,10
1655 C IF CURTAILING RUNNING STAGE MARK FOR COMPENSATION AND PUT IN V.A. DEM
1656 9 CHOP=RST
1657 OEM(JN,RST)=1
1658 MAXGT(JN)=0
1659 MINGT(JN)=0
1660 EXTT(JN)=0
1661 SVEXTT(JN) = 0
1662 SVMXGT(JN) = 0
1663 GO TO 12
1664 C IF HAVE A V.A. CHANGE SET V.A. DEMAND.
1665 10 CHOP=0
1666 IF (MAXGT(JN)) 13,13,14
1667 13 DEM(JN,RST)=1
1668 MAXGT(JN)=0
1669 GO TO 12
1670 14 DEM(JN,RST)=0
1671 MAXGT(JN)=0
1672 CMPST=RST
1673 ST=SST-1
1674 17 CHANGE(JN,1)=NEWST
1675 CHANGE(JN,2) = 4
1676 FST(JN) = NEWST
1677 IF (IPRINT) 20,21,20
1678 21 WRITE(6,100) MSEC,JNST(JN),RST,NEWST
1679 100 FORMAT(' MSEC =',15,' JUNCTIDN',13,' PRIORITY CHANGE FRDM',12,'TD'
1680 1,12)

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1681      20 IF (MSEC-START) 18,18,19
1682      19 FRCCNG(JN,RST,NEWST) = FRCCNG(JN,RST,NEWST) + 1
1683      18 CALL CMPN(JN,1,ST,CHOP)
1684      GO TO 11
1685      END
1686      SUBROUTINE READ
1687      IMPLICIT INTEGER(A-Z)
1688      INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
1689      INTEGER*4 JUN,OET,ENTRY,JST,EST,OST,CARS,OTCN,NSTOP,OUTOAT,COUT,
1690      1MLANE,BLANE,LTH,VELO,OETINT,
1691      2ENT
1692      REAL*8 TIM
1693      DIMENSION JUN(75,30),OET(120,15),OECTR(75),ENTRY(40,6),
1694      1JST(75),OST(120),EST(40),CAR5(750,4),JTST(75),OTCN(75),
1695      2OLY(75),NSTOP(75),OUTOAT(12,3),COUT(5,2),
1696      3SATN(3),COUN(5),OCN(3),
1697      4MLANE(6,8),BLANE(6,4),LTH(75),VELO(75),OETINT(120),
1698      5ENT(8)
1699      COMMON JUN,OET,OECTR,ENTRY,JST,OST,EST,CARS,MSEC,
1700      1JTST,OTCN,DLY,NSTOP,OUTOAT,COUT,NOUT,NPER,
1701      2MLANE,BLANE,LTH,VELO,OETINT,BM,BUS
1702      COMMON/COM1/SATN,COUN,OCN,VLTH,
1703      1ENOT,RNGE,SPEED,NVEH,UCST,LCST,RN,OOELAY
1704      998 FORMAT(' ','*****')
1705      999 FORMAT(4G10)
1706      1000 FORMAT(G10)
1707      1001 FORMAT(3G10)
1708      1002 FORMAT (6G10)
1709      1003 FORMAT(8G10)
1710      1004 FORMAT(' ','STOPLINE DATA')
1711      1005 FORMAT('O','DETECTOR DATA')
1712      1006 FORMAT(' ')
1713      1007 FORMAT('O','VEHICLE LENGTH      ',G10/'O','END TIME
1714      1G10/'O','VELOCITY RANGE      ',G10/'O','ENTRY SPEED      ',G10)
1715      1008 FORMAT('O','RANDOM NUMBER SEED ',G10)
1716      1009 FORMAT('O','NUMBER OF VEHICLES ',G10)
1717      1013 FORMAT('O','ENTRY DATA')
1718      1014 FORMAT('O','EXIT DATA')
1719      1016 FORMAT (3G10)
1720      1017 FORMAT('O',T8,'STOPLINE STORE',15X,'DETECTOR STORE',
1721      119X,'ENTRY/EXIT')
1722      1018 FORMAT(' ',2G10,9X,2G10,9X,2G10)
1723      1019 FORMAT(' ',2G10,9X,2G10)
1724      1020 FORMAT(' ',T20,'FAULT IN JUNCTION DATA AT ',G10,' ERROR ',G10)
1725      1021 FORMAT(' ',T20,'FAULT IN DETECTOR DATA AT ',G10,' ERROR ',G10)
1726      1022 FORMAT(' ',T20,'FAULT IN ENTRY DATA AT ',G10,' ERROR ',G10)
1727      1024 FORMAT(' ',8G10)
1728      1032 FORMAT(18G4)
1729      1033 FORMAT(' ',T20,'FAULT IN OUTOAT AT ',G10,'ERROR',G10)
1730      1034 FORMAT('O','*',G5,'*',8G7)
1731      1035 FORMAT(' ',G7,7X,4G7)
1732      1036 FORMAT(' ',14X,4G7)
1733      1037 FORMAT(' ',*,G5,'*',3G7)
1734      1038 FORMAT(' ',*,G5,'*',3G7,11X,'*',G5,'*',3G7)
1735      1039 FORMAT(' ',*,G5,'*',3G7,11X,'*',G5,'*',3G7,11X,'*',G5,'*',3G7)
1736      1040 FORMAT('O','*',G5,'*',4G7)
1737      1041 FORMAT('O','*',G5,'*',4G7,5X,'*',G5,'*',4G7)
1738      1042 FORMAT('O','*',G5,'*',4G7,5X,'*',G5,'*',4G7,5X,'*',G5,'*',4G7)
1739      1043 FORMAT(' ',5G7)
1740      1044 FORMAT(' ',5G7,5X,5G7)

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1741      1045 FORMAT(' ',5G7,5X,5G7,5X,5G7)
1742      C DATA COLLECTION ROUTINES, COUN(1) HOLOS NUMBER OF DECISIONS
1743      C READ IN JUNCTION DATA
1744      401 PL=1
1745      C T=0 IMPLIES NO PRINTOUT OF COMPUTER NUMBERS FOR JUN,OET,ENTRY
1746      READ (5,1016) COUN(1),T,OOELAY
1747      C STORE JUNCTION NUMBER
1748      C STORE NEXT LINK DECISION NUMBERS, THROUGH, LEFT, RIGHT
1749      C STORE SATURATION FLOW
1750      C STORE NUMBER OF LANES
1751      C STORE VELOCITY
1752      C STORE DISTANCE TO NEXT LINK
1753      402 READ(5,1002)JST(PL),JUN(PL,21),JUN(PL,22),LTH(PL),VELO(PL)
1754      1,JUN(PL,29)
1755      READ(5,1002)JUN(PL,3),JUN(PL,6),JUN(PL,12),JUN(PL,15),JUN(PL,18)
1756      READ(5,1002)JUN(PL,4),JUN(PL,7),JUN(PL,13),JUN(PL,16),JUN(PL,19)
1757      READ(5,1002)JUN(PL,5),JUN(PL,8),JUN(PL,14),JUN(PL,17),JUN(PL,20)
1758      DO 403 J = 9,11
1759      JUN(PL,J) = 0
1760      403 CONTINUE
1761      DO 404 J=23,28
1762      JUN(PL,J)=0
1763      404 CONTINUE
1764      DO 9412 I=6,8
1765      IF(JUN(PL,I).LE.0)GO TO 9412
1766      JUN(PL,I)=JUN(PL,I)/36
1767      9412 CONTINUE
1768      DO 8412 I=15,17
1769      Z = JUN(PL,I)
1770      Z = Z/3.6+0.5
1771      JUN(PL,I)=Z
1772      8412 CONTINUE
1773      Z=VELO(PL)
1774      Z=Z/3.6+0.5
1775      VELO(PL)=Z
1776      JUN(PL,1) = 0
1777      JUN(PL,2) = 0
1778      PL=PL+1
1779      IF(PL.LE.COUN(1)) GO TO 402
1780      C -----
1781      C WRITE STOPLINE DATA
1782      WRITE(6,1004)
1783      WRITE(6,998)
1784      PL=1
1785      C CODING TO LABEL 408 CALCULATES HOW MANY DATA BLOCKS CAN BE
1786      C PRINTED ON THIS LINE
1787      WRITE(6,1006)
1788      405 IF(COUN(1)-(PL+1))406,407,408
1789      406 WRITE(6,1040)JST(PL),(JUN(PL,1),I=21,22),VELO(PL),LTH(PL)
1790      WRITE(6,1043)(JUN(PL,1),I=3,6,3),(JUN(PL,1),I=12,18,3)
1791      WRITE(6,1043)(JUN(PL,1),I=4,7,3),(JUN(PL,1),I=13,19,3)
1792      WRITE(6,1043)(JUN(PL,1),I=5,8,3),(JUN(PL,1),I=14,20,3)
1793      GO TO 409
1794      407 WRITE(6,1041)JST(PL),(JUN(PL,1),I=21,22),VELO(PL),LTH(PL),
1795      1JST(PL+1),(JUN(PL+1,1),I=21,22),VELO(PL+1),LTH(PL+1)
1796      WRITE(6,1044)(JUN(PL,1),I=3,6,3),(JUN(PL,1),I=12,18,3),
1797      1(JUN(PL+1,1),I=3,6,3),(JUN(PL+1,1),I=12,18,3)
1798      WRITE(6,1044)(JUN(PL,1),I=4,7,3),(JUN(PL,1),I=13,19,3),
1799      1(JUN(PL+1,1),I=4,7,3),(JUN(PL+1,1),I=13,19,3)
1800      WRITE(6,1044)(JUN(PL,1),I=5,8,3),(JUN(PL,1),I=14,20,3),

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1801      1(JUN(PL+1,1),I=5,8,3),(JUN(PL+1,1),I=14,20,3)
1802      GO TO 409
1803      408 WRITE(6,1042)JST(PL),(JUN(PL,1),I=21,22),VELD(PL),LTH(PL),
1804      1JST(PL+1),(JUN(PL+1,1),I=21,22),VELO(PL+1),LTH(PL+1),
1805      2JST(PL+2),(JUN(PL+2,1),I=21,22),VELO(PL+2),LTH(PL+2)
1806      WRITE(6,1045)(JUN(PL,1),I=3,6,3),(JUN(PL,1),I=12,18,3),
1807      1(JUN(PL+1,1),I=3,6,3),(JUN(PL+1,1),I=12,18,3),
1808      2(JUN(PL+2,1),I=3,6,3),(JUN(PL+2,1),I=12,18,3)
1809      WRITE(6,1045)(JUN(PL,1),I=4,7,3),(JUN(PL,1),I=13,19,3),
1810      1(JUN(PL+1,1),I=4,7,3),(JUN(PL+1,1),I=13,19,3),
1811      2(JUN(PL+2,1),I=4,7,3),(JUN(PL+2,1),I=13,19,3)
1812      WRITE(6,1045)(JUN(PL,1),I=5,8,3),(JUN(PL,1),I=14,20,3),
1813      1(JUN(PL+1,1),I=5,8,3),(JUN(PL+1,1),I=14,20,3),
1814      2(JUN(PL+2,1),I=5,8,3),(JUN(PL+2,1),I=14,20,3)
1815      PL=PL+3
1816      IF(PL.LE.COUN(1))GO TO 405
1817      C -----
1818      C READ IN DETECTOR DATA
1819      409 READ(5,1000)COUN(2)
1820      PL=1
1821      C STORE DETECTOR NUMBER
1822      C STORE NEXT DECISION DISTANCE TO NEXT DECISION AND NUMBER OF LANES
1823      C STORE PERCENTS TURNING LEFT RIGHT AND PERCENT TURNING LEFT
1824      KB = 0
1825      KM = 0
1826      413 READ(5,1003)DST(PL),(DET(PL,1),I=3,5),(DET(PL,1),I=8,10),
1827      1DET(PL,12)
1828      DET(PL,14) = DET(PL,4)*DET(PL,5)
1829      IF(DET(PL,10)-7) 3,1,2
1830      1 KB = KB + 1
1831      READ(5,1003)(BLANE(KB,I),I = 1,4)
1832      DET(PL,11) = KB
1833      GO TO 3
1834      2 KM = KM + 1
1835      READ(5,1003)(MLANE(KM,I),I = 1,8)
1836      DET(PL,11) = KM
1837      3 DET(PL,1) = 0
1838      DET(PL,2)=0
1839      DET(PL,6)=0
1840      DET(PL,7)=0
1841      DET(PL,8)=10*DET(PL,8)
1842      DET(PL,9)=10*DET(PL,9)
1843      PL=PL+1
1844      IF(PL.LE.COUN(2)) GO TO 413
1845      C -----
1846      C WRITE DETECTOR DATA
1847      WRITE(6,1005)
1848      WRITE(6,998)
1849      PL=1
1850      414 IF(PL.GT.COUN(2))GO TO 8418
1851      WRITE(6,1034)DST(PL),DET(PL,10),DET(PL,3),DET(PL,12),DET(PL,4),
1852      1DET(PL,5),DET(PL,8),DET(PL,9)
1853      IF(DET(PL,10)-7)417,415,416
1854      415 K=DET(PL,11)
1855      WRITE(6,1035)DET(PL,11),(BLANE(K,I),I=1,4)
1856      GO TO 417
1857      416 K=DET(PL,11)
1858      WRITE(6,1035)DET(PL,11),(MLANE(K,I),I=1,4)
1859      WRITE(6,1036)(MLANE(K,I),I=5,8)
1860      417 PL=PL+1

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1861      GO TO 414
1862      C ZERO DETR ARRAY
1863      8418 L = COUN(2)
1864      DO 9418 PL=1,L
1865      DETR(PL) = 0
1866      9418 CDNTINUE
1867      C -----
1868      C READ ENTRY DATA
1869      PL=1
1870      ENTRY(40,6)=0
1871      READ(5,999)COUN(3),NOCHT
1872      C READ IN DECISION NUMBER
1873      C READ IN PROBABILITY OF CAR ENTERING NETWRK, 'NEXT DECISION AND
1874      C DELAY TIMER IF NECESSARY
1875      419 READ(5,999)EST(PL),(ENTRY(PL,1),I=3,5)
1876      ENTRY(PL,1)=0
1877      ENTRY(PL,2)=0
1878      ENTRY(PL,3) = 10*ENTRY(PL,3)
1879      Z = ENTRY(PL,3)/36+0.5
1880      ENTRY(PL,3) = Z*10
1881      ENTRY(PL,6)=0
1882      PL=PL+1
1883      IF(PL.LE.COUN(3))GO TO 419
1884      C READ EXIT DATA
1885      PL = COUN(3)
1886      READ(5,1000)CDUN(5)
1887      NOATA = CDUN(5)
1888      END = COUN(3) + COUN(5)
1889      9419 READ(5,1003) (ENT(N),N=1,8)
1890      IF(NDATA.LT.8) GO TO 12
1891      DO 11 N=1,8
1892      J=PL+N
1893      EST(J)=ENT(N)
1894      11 CONTINUE
1895      PL = PL+8
1896      IF(PL.EQ.END) GO TO 14
1897      NDATA = NDATA-8
1898      GO TO 9419
1899      12 DO 13 N=1,NOATA
1900      J=PL+N
1901      EST(J)=ENT(N)
1902      13 CDNTINUE
1903      C ZERO EXIT POINT ARRAYS
1904      14 NL = CDUN(3) + 1
1905      TEND = END + 1
1906      DO 16 PL=NL,TEND
1907      DD 15 N=1,6
1908      ENTRY(PL,N) = 0
1909      15 CONTINUE
1910      16 CONTINUE
1911      C -----
1912      C WRITE ENTRY DATA
1913      WRITE(6,1013)
1914      WRITE(6,998)
1915      PL=1
1916      420 IF(COUN(3)-(PL+1))421,422,423
1917      421 WRITE(6,1037)EST(PL),(ENTRY(PL,1),I=3,5)
1918      GO TO 424
1919      422 WRITE(6,1038)EST(PL),(ENTRY(PL,1),I=3,5),
1920      1EST(PL+1),(ENTRY(PL+1,1),I=3,5)

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1921      GD TO 424
1922      423 WRITE(6,1039)EST(PL),(ENTRY(PL,1),I=3,S),
1923      1EST(PL+1),(ENTRY(PL+1,1),I=3,S),
1924      2EST(PL+2),(ENTRY(PL+2,1),I=3,S)
1925      PL=PL+3
1926      IF(PL.LE.COUN(3))GD TO 420
1927      C WRITE EXIT DATA
1928      424 WRITE(6,1014)
1929      WRITE(6,998)
1930      NDATA = COUN(5)
1931      A1 = CDUN(3) + 1
1932      20 IF(NDATA.LT.8) GD TO 21
1933      A2 = A1 + 7
1934      WRITE(6,1003) (EST(N),N=A1,A2)
1935      NDATA = NDATA - 8
1936      A1 = A1 + 8
1937      IF((A1-1).EQ.END) GD TO 22
1938      GO TO 20
1939      21 A2 = A1 + NDATA - 1
1940      WRITE(6,1003) (EST(N),N=A1,A2)
1941      C REPLACE DRIGNAL NUMBERING BY PROGRAM NUMBERING FOR STOPLINE
1942      22 FIN=COUN(1)
1943      DO 8438 PL=1,FIN
1944      DO 438 I=1,3
1945      TEST=JUN(PL,I+2)
1946      C IS NEXT DECISION-THRO,LEFT,RIGHT, AN EXIT
1947      IF(TEST.EQ.0)GD TO 438
1948      L=COUN(2)
1949      DO 434 J=1,L
1950      C IS NEXT DECISION-THRO,LEFT,RIGHT, A DETECTOR
1951      IF(TEST.EQ.DST(J))GD TO 436
1952      434 CONTINUE
1953      M=COUN(3)
1954      L = COUN(3) + COUN(5)
1955      M=M+1
1956      DO 435 J=M,L
1957      C IS NEXT DECISION-THRO,LEFT,RIGHT, AN ENTRY
1958      IF(TEST.EQ.EST(J))GD TO 437
1959      435 CONTINUE
1960      C FAIL MESSAGE
1961      WRITE(6,1020) JST(PL),JUN(PL,I+2)
1962      GO TO 438
1963      C STOPLINE DATA,DETECTORS POSITIVE,EXITS NEGATIVE
1964      436 JUN(PL,I+2)=J
1965      GO TO 438
1966      437 JUN(PL,I+2)=-J
1967      438 CONTINUE
1968      8438 CONTINUE
1969      C CDNVERT RIGHT TURN OPPDSING STOPLINE NO.
1970      DO 441 PL=1,FIN
1971      TEST = JUN(PL,21)
1972      IF(TEST.EQ.0)GD TO 441
1973      DO 439 I=1,FIN
1974      IF(TEST.EQ.JST(I))GD TO 440
1975      439 CONTINUE
1976      C FAIL MESSAGE
1977      WRITE(6,1020) JST(PL),JUN(PL,21)
1978      JUN(PL,21) = 0
1979      GO TO 441
1980      440 JUN(PL,21)=1

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1981      441 CONTINUE
1982      C -----
1983      C REPLACE DRIGNAL NUMBERING BY PRDGRAM NUMBERING IN DETECTOR
1984      PL = 0
1985      FIN = COUN(1)
1986      FIND = CDUN(2)
1987      30 PL = PL + 1
1988      IF(PL.GT.FIND) GD TO 45
1989      MARK = 0
1990      TEST = DET(PL,3)
1991      TYPE = DET(PL,12)
1992      31 IF(TYPE.EQ.1) GD TO 34
1993      DO 32 I = 1,FIND
1994      IF(TEST.EQ.DST(I))GD TD 33
1995      32 CONTINUE
1996      C FAIL MESSAGE
1997      WRITE(6,1021) DST(PL)
1998      33 IF(MARK.NE.0) GD TO 41
1999      DET(PL,3) = 1
2000      GO TO 37
2001      34 DO 35 I = 1,FIN
2002      IF(TEST.EQ.JST(I))GD TD 36
2003      35 CONTINUE
2004      C FAIL MESSAGE
2005      WRITE(6,1021)DST(PL)
2006      36 IF(MARK.NE.0) GD TD 41
2007      DET(PL,3) = 1
2008      37 IF(DET(PL,10)-7)30,38,39
2009      38 K = DET(PL,11)
2010      TEST = BLANE(K,1)
2011      TYPE = BLANE(K,2)
2012      MARK = 1
2013      GD TD 31
2014      39 K = DET(PL,11)
2015      TEST = MLANE(K,1)
2016      TYPE = MLANE(K,2)
2017      MARK = 2
2018      GO TO 31
2019      40 TEST = MLANE(K,5)
2020      TYPE = MLANE(K,6)
2021      MARK = 3
2022      GO TO 31
2023      41 IF(MARK = 2)42,43,44
2024      42 BLANE(K,1) = 1
2025      GD TO 30
2026      43 MLANE(K,1) = 1
2027      GD TO 40
2028      44 MLANE(K,5) = 1
2029      GD TD 30
2030      C -----
2031      C REPLACE DRIGNAL NUMBERING BY PROGRAM NUMBERING IN ENTRY/EXIT
2032      45 FIN = COUN(3)
2033      DO 447 PL=1,FIN
2034      TEST = ENTRY(PL,4)
2035      IF(TEST.EQ.0)GD TO 447
2036      L = COUN(2)
2037      DO 445 J=1,L
2038      IF(TEST.EQ.DST(J))GD TD 446
2039      445 CONTINUE
2040      C FAIL MESSAGE

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2041      WRITE(6,1022)EST(PL),ENTRY(PL,4)
2042      GO TO 447
2043      446 ENTRY(PL,4)=J
2044      447 CONTINUE
2045      C CARRY ON READING IN DATA
2046      C GO TO 426
2047      C -----
2048      C READ IN VEHICLE LENGTH, END TIME, VELOCITY RANGE, INITIAL SPEED
2049      426 CHNO=0
2050      CALL VARFLO(NOCHT)
2051      50 READ(5,1002)VLTH,ENDT,RNGE,SPEED
2052      TOTDET = COUN(2)
2053      DO 200 IDET = 1,TOTDET
2054      DET(IDET,14) = DET(IDET,14)/VLTH
2055      200 DET(IDET,15) = (DET(IDET,14) + 1)/2
2056      WRITE (6,1100) (OST(IJ),DET(IJ,14),DET(IJ,15),IJ = 1,TOTDET)
2057      1100 FORMAT (' DETECTOR, NUMBER OF CARS WHEN THE LIGHTS ARE RED',
2058      1' AND GREEN',/,S(317,SX))
2059      WRITE(6,1007) VLTH,ENDT,RNGE,SPEED
2060      Z = SPEED
2061      Z=Z/3.6
2062      Z=Z+0.5
2063      SPEED=Z
2064      C READ IN RANDOM NUMBER SEED AND NUMBER OF VEHICLES
2065      READ(S,1000) RN
2066      WRITE(6,1008) RN
2067      RN=GGUBFS(RN)
2068      READ(S,1000) NVEH
2069      WRITE(6,1009) NVEH
2070      C -----
2071      C SET UP USEABLE CAR STORE LIST
2072      DO 427 I=1,NVEH
2073      CARS(I,1) = 0
2074      CARS(I,2) = 0
2075      CARS(I,3) = 0
2076      CARS(I,4)=I+1
2077      427 CONTINUE
2078      CARS(NVEH,4) = 0
2079      UCST=1
2080      LCST = 1
2081      C -----
2082      C ZERO DELAY COUNTERS
2083      X = COUN(1)
2084      428 DO 429 I=1,X
2085      DLY(I) = 0
2086      JTST(I) = 0
2087      OTCN(I) = 0
2088      NSTOP(I) = 0
2089      429 CONTINUE
2090      C -----
2091      C READ OUT PARAMETER CAROS
2092      READ(S,1003)NPER,NOUT,((COUT(I,J),J=1,2),I=1,NPER)
2093      IF(NPER.EQ.0)GO TO 8429
2094      K=1
2095      IF(NOUT.GT.6)K=2
2096      DO 9429 L=1,K
2097      H=6*(L-1)+1
2098      M=H+S
2099      READ(S,1032)((OUTOAT(I,J),J=1,3),I=H,M)
2100      9429 CONTINUE

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2101      DO 326 I=1,NOUT
2102      L = COUN(1)
2103      IF(OUTOAT(I,2).EQ.1)GO TO 26
2104      L=COUN(2)
2105      TEST = OUTOAT(I,3)
2106      DO 23 J = 1,L
2107      IF(TEST.EQ.OST(J)) GO TO 24
2108      23 CONTINUE
2109      WRITE(6,1033)OST(I),OUTOAT(I,3)
2110      GO TO 326
2111      24 OUTOAT(I,3) = J
2112      GO TO 326
2113      26 TEST = OUTOAT(I,3)
2114      DO 27 J = 1,L
2115      IF(TEST.EQ.JST(J)) GO TO 28
2116      27 CONTINUE
2117      WRITE(6,1033)JST(I),OUTOAT(I,3)
2118      GO TO 326
2119      28 OUTOAT(I,3) = J
2120      326 CONTINUE
2121      C WRITE OUT PROGRAM NUMBERS AGAINST INPUT NUMBERS FOR STOPLINE
2122      C DECISION DATA
2123      C WRITE OUT PROGRAM NUMBERS AGAINST INPUT NUMBERS FOR DETECTOR
2124      C DECISION DATA
2125      C WRITE OUT PROGRAM NUMBERS AGAINST INPUT NUMBERS FOR ENTRY/EXIT
2126      C DECISION DATA
2127      C8429 IF(T.EQ.0)GO TO 432
2128      C WRITE(6,1017)
2129      C WRITE(6,1006)
2130      C L = COUN(3)+COUN(5)
2131      C DO 430 I=1,L
2132      C WRITE(6,1018)I,JST(I),I,OST(I),I,EST(I)
2133      C 430 CONTINUE
2134      C M=COUN(1)
2135      C L=L+1
2136      C DO 431 I=L,M
2137      C WRITE(6,1019)I,JST(I),I,OST(I)
2138      C 431 CONTINUE
2139      C ---CALCULATE THE PREVIOUS DECISION POINT FOR QUEUE-----
2140      C 432 N=COUN(1)
2141      8429 N = COUN(1)
2142      DO 100 I=1,N
2143      100 JUN(I,30) = 0
2144      N = COUN(2)
2145      DO 101 I=1,N
2146      101 DET(I,13) = 0
2147      DO 102 I=1,N
2148      A = DET(I,3)
2149      C 15 THIS DETECTOR FOLLOWED BY ANOTHER DETECTOR OR A STOPLINE?
2150      IF (DET(I,12) - 1) 103,104,103
2151      103 DET(A,13) = 1
2152      GO TO 102
2153      104 JUN(A,30) = 1
2154      102 CONTINUE
2155      C -----
2156      C GO TO START OF MAIN CYCLE
2157      C RETURN
2158      C ENO
2159      C SUBROUTINE 55VH(N1)
2160      C SPECIAL VEHICLE SUBROUTINES

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2161 C THIS MODULE GIVES MODE 2 OUTPUT
2162 C READ AND STORE SP. VEH. DATA AT START OF PRDGRAM
2163 C N1 = NUMBER OF STOP LINES AND DETECTORS IN NETWORK
2164 IMPLICIT INTEGER(A-Z)
2165 INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
2166 INTEGER*4 JUN, DET, ENTRY, JST, EST, OST, CARS, OTCN, NSTOP, OUTDAT, COUT,
2167 1MLANE, BLANE, LTH, VELO, DETINT, SVSTRT
2168 REAL*8 TIM
2169 DIMENSION JUN(75,30), OET(120,15), DECTR(75), ENTRY(40,6),
2170 1JST(75), DST(120), EST(40), CARS(750,4), JTST(75), OTCN(75),
2171 2DLY(75), NSTDP(75), OUTDAT(12,3), COUT(5,2),
2172 3SATN(3), CDUN(5), OCN(3),
2173 4MLANE(6,8), BLANE(6,4), LTH(75), VELO(75), DETINT(120),
2174 SSVST(100,11), SVOL(100,5)
2175 COMMON JUN, DET, DECTR, ENTRY, JST, OST, EST, CARS, MSEC,
2176 1JTST, DTCN, DLY, NSTOP, OUTDAT, COUT, NOUT, NPER,
2177 2MLANE, BLANE, LTH, VELD, DETINT, BM, BUS
2178 COMMON/COM1/SATN, COUN, OCN, VLTH,
2179 1ENOT, RNGE, SPEED, NVEH, UCST, LCST, RN, ODELAY
2180 COMMON /BLKSVH/ SVST, SVDL, NSPVEH, START,
2181 1 SVSTRT(100), IPRINT
2182 1000 FORMAT (2G10)
2183 1001 FORMAT (7G10)
2184 1002 FORMAT(' ', 'SPECIAL VEHICLE DATA NOT FOUND')
2185 1004 FORMAT(' ', '*****')
2186 1005 FORMAT(' ')
2187 1012 FORMAT('O', 'INVALID DECISION PDINT CODE IN SVEH')
2188 1014 FDMAT(' ', T20, 'FAULT IN SSVH', G10, G10)
2189 1015 FORMAT(' ', T20, 'ND SPECIAL CAR DATA')
2190 1016 FDMAT(' ', 3G6, 3G10, 2G6)
2191 1017 FORMAT(' ', 'SPECIAL VEHICLE DATA')
2192 1 READ (5,1000) N, NTHCAR
2193 C N = NUMBER OF SP. VEHICLES FOR THIS RUN
2194 IF(N.EQ.0) GO TO 304
2195 PL=1
2196 2 READ (5,1001) (SVST(PL,I), I=1,6), SVST(PL,8)
2197 SVST(PL,7) = 0
2198 SVST(PL,9) = 0
2199 SVST(PL,10) = 0
2200 SVST(PL,11) = 0
2201 IF(PL.EQ.N) GO TO 300
2202 PL=PL+1
2203 GO TO 2
2204 C TYPE 0 BUS JOURNEYS ARE NOT ALLOWED.
2205 300 DO 4 I=1,N
2206 IF (SVST(I,8)) 9,9,4
2207 4 CDNTINUE
2208 GO TO 10
2209 9 DO 11 I=1,N
2210 11 SVST(I,8) = SVST(I,8) + 1
2211 C REPLACE START PDINT NUMBERS BY COMPUTER DETECTDR NUMBERS
2212 10 DO 302 PL = 1,N
2213 SVSTRT(PL) = NTHCAR
2214 TEST = SVST(PL,2)
2215 DO 301 I = 1,N1
2216 IF(TEST.EQ.OST(I)) GO TO 303
2217 301 CDNTINUE
2218 WRITE(6,1014) PL, SVST(PL,2)
2219 302 CDNTINUE
2220 C PRINT OUT ALL SP. VEH. DATA BLDCKS

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2221 WRITE(6,1017)
2222 WRITE(6,1004)
2223 WRITE(6,1005)
2224 DO 9302 PL = 1,N
2225 I = SVST(PL,2)
2226 WRITE (6,1016) PL, SVST(PL,1), OST(I), (SVST(PL,P), P=3,6), SVST(PL,8)
2227 9302 CDNTINUE
2228 C GENERATE SPECIAL VEHICLE DATA QUEUE IN SVOL
2229 DO 9303 K=1,99
2230 DD 9304 A=1,4
2231 SVOL(K,A) = 0
2232 9304 CONTINUE
2233 SVDL(K,5) = K+1
2234 9303 CONTINUE
2235 SVDL(100,5) = 0
2236 NOSN = 1
2237 MDST = 1
2238 C NDSN = NEXT DATA STORE NO. MDSN = MAXIMUM DATA STORE NO.
2239 RETURN
2240 303 SVST(PL,2) = 1
2241 GO TO 302
2242 304 WRITE(6,1015)
2243 3 RETURN
2244 C -----
2245 ENTRY ISVH
2246 C INITIATE SPECIAL VEHICLES (ENTERED ONCE EACH SECDNO)
2247 IF(N.EQ.0) RETURN
2248 DO 8 PL=1,N
2249 IF(SVST(PL,1).NE.MSEC) GO TO 8
2250 C IF START TIME = MSEC ATTEMPT TO GENERATE A SP. VEHICLE
2251 ANLK=SVST(PL,2)
2252 C ANLK = START POINT ( A DETECTOR )
2253 C IF NO VEHICLES AT THIS DETECTDR GO TO 6
2254 IF(DET(ANLK,1).EQ.0) GO TO 6
2255 C START A SPECIAL VEHICLE ON THE NTHCAR VEHICLE.
2256 IF (SVSTRT(PL) - 1) 12,12,13
2257 13 SVSTRT(PL) = SVSTRT(PL) - 1
2258 GO TO 6
2259 12 AVEH=DET(ANLK,1)
2260 5 IF(CARS(AVEH,3).LT.0) GO TO 7
2261 C CHANGE FIRST NDN SP. VEH. INTO A SP. VEH. (NEG.VELOCITY = SP.VEH.)
2262 CARS(AVEH,3)=-CARS(AVEH,3)
2263 C STORE ACTUAL VEHICLE NUMBER
2264 SVST(PL,3)=AVEH
2265 SVST(PL,2) = 0
2266 C CALCULATE TURNING CODE
2267 P = PL
2268 MARK4 = 5
2269 GO TO 23
2270 95 GO TO 8
2271 C DELAY INITIATION BY INCREMENTING START TIME
2272 6 SVST(PL,1)=SVST(PL,1)+1
2273 GO TO 8
2274 7 AVEH=CARS(AVEH,4)
2275 IF(AVEH.EQ.0) GO TO 6
2276 GO TO 5
2277 8 CDNTINUE
2278 RETURN
2279 C -----
2280 ENTRY SVH1(AV1,PL3)

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2281 C GENERATE SPECIAL VEHICLE TURNING CODE
2282 C AV1 = ACTUAL VEHICLE NUMBER FOR THIS SP VEHICLE
2283 C PL3 = DETECTOR NUMBER
2284 C TURNING CODES. 1 = THROUGH 2 = LEFT 3 = RIGHT
2285 C AVEH=AV1
2286 C ANLK = PL3
2287 C IF(ANLK.LE.0) RETURN
2288 C MARK4 = 0
2289 C LOCATE CORRECT SP. VEH. DATA BLOCK
2290 C P=1
2291 21 IF(AVEH.EQ.SVST(P,3)) GO TO 23
2292 C P=P+1
2293 C IF(P.GT.N) GO TO 22
2294 C GO TO 21
2295 22 WRITE(6,1002)
2296 C RETURN
2297 C TAKE OUT PRESTORED TURNING CODE IF THERE IS ONE
2298 23 Q=4
2299 25 DRNW=SVST(P,Q)
2300 C IF(DRNW.EQ.0) GO TO 100
2301 C TEMP1=DRNW/10
2302 C CODE=DRNW-10*TEMP1
2303 C SVST(P,Q)=TEMP1
2304 C IF(CODE.GT.0) GO TO 26
2305 100 Q=Q+1
2306 C IF(Q.LE.6) GO TO 25
2307 C GO TO 27
2308 C STORE TURNING CODE IN VEHICLE AND RETURN
2309 26 IF(CODE.GT.3) GO TO 27
2310 C CARS(AVEH,2) = CODE
2311 C GO TO 210
2312 C NO PRESTORED CODES, GENERATE RANDOM TURNING CODE
2313 27 RNS = GGUBFS(10000) + 1
2314 C IF(RNS.LE.DET(ANLK,8)) GO TO 28
2315 C R = DET(ANLK,8) + DET(ANLK,9)
2316 C IF(RNS.LE.R) GO TO 29
2317 C CARS(AVEH,2)=1
2318 C GO TO 210
2319 28 CARS(AVEH,2)=2
2320 C GO TO 210
2321 29 CARS(AVEH,2)=3
2322 210 TEMP = DECTR(ANLK)
2323 C IF(MARK4.EQ.5) GO TO 8
2324 C RETURN
2325 C -----
2326 C ENTRY SVEH(A1,A2,A3,A4,A5)
2327 C STORE AND PRINT SPECIAL VEHICLE OUTPUT DATA
2328 C ENTERED WHENEVER A SPECIAL VEHICLE REACHES A DECISION POINT
2329 C TYPE 1= STOPLINE, 2= DETECTOR, 3= EXIT
2330 C PL IS THE CURRENT DECISION POINT NUMBER
2331 1003 FORMAT('O','MORE SPECIAL VEHICLES THAN DATA PERMITS')
2332 1019 FORMAT('O',' ')
2333 1021 FORMAT('/O','T20','SP. VEH.','G5,T96','START-TIME',G8)
2334 1022 FORMAT('O','T21','STOPL',T41,'J-T FROM',T65,'DELAY',T85,'DIST',' ',
2335 1T15,G10,T40,'PREV.STOPL')
2336 1023 FORMAT(' ',T15,G10,T37,G10,T59,G10,T78,G10)
2337 1020 FORMAT('O','MAXIMUM DATA STORE NUMBER IN SVEH EQUALS ',G4)
2338 1028 FORMAT(' ',T21,'TOTALS',T37,G10,T59,G10,T78,G10,T96,
2339 1'END-TIME',G10)
2340 1030 FORMAT(' ',T44,'---',T66,'---',T84,'---')

2341 1031 FORMAT('O','INCORRECT DEC.PT.CODE',G5,'BUS NO.',G5)
2342 1032 FORMAT('O','INCORRECT DEC.PT. NO.',G10,'BUS NO.',G5)
2343 1033 FORMAT('O','ERROR IN SVEH',4G10)
2344 C PL1 = A1
2345 C J1 = A2
2346 C AVEH = A3
2347 C PL2 = A4
2348 C J2 = A5
2349 C S = 1
2350 101 IF(AVEH.EQ.SVST(S,3))GO TO 103
2351 C S = S + 1
2352 C IF(S.GT.N) GO TO 102
2353 C GO TO 101
2354 102 WRITE(6,1003)
2355 C RETURN
2356 103 IF(PL1.EQ.1) GO TO 106
2357 C IF(PL1.EQ.3) GO TO 119
2358 C STORE = SVST(S,7)
2359 C IF(STORE.EQ.0) RETURN
2360 C IF((SVOL(STORE,2)/100000).EQ.PL1)GO TO 104
2361 C WRITE(6,1031) PL1,S
2362 104 IF((SVOL(STORE,2)-100000*PL1).EQ.J1) GO TO 105
2363 C WRITE(6,1032) DST(J1),S
2364 105 SVOL(STORE,2) = J2 + 100000*PL2
2365 C SVOL(STORE,4) = SVOL(STORE,4) + CARS(AVEH,1)
2366 C RETURN
2367 106 IF(NOSN.LE.0) GO TO 111
2368 107 STORE = SVST(S,7)
2369 C IF(STORE.EQ.0) GO TO 110
2370 C SVOL(STORE,5) = NOSN
2371 108 SVST(S,7) = NOSN
2372 C SVOL(NOSN,1) = J1 + 100000*PL1
2373 C SVOL(NOSN,2) = J2 + 100000*PL2
2374 C SVOL(NOSN,3) = MSEC + 100000*S
2375 C T2 = MSEC + CARS(AVEH,1)
2376 C VEL = -CARS(AVEH,3)
2377 C SVOL(NOSN,4) = T2 + 100000*VEL
2378 C STORE = NOSN
2379 C NOSN = SVOL(NOSN,5)
2380 C IF(NOSN.LE.MOST) GO TO 109
2381 C MOST = NOSN
2382 109 SVOL(STORE,5) = 0
2383 C RETURN
2384 110 SVST(S,2) = NOSN
2385 C GO TO 108
2386 111 S2 = 1
2387 112 STORE = SVST(S2,7)
2388 C IF(STORE.EQ.0)GO TO 113
2389 C MARK = 5
2390 C GO TO 114
2391 113 IF(S2.EQ.N)GO TO 213
2392 C S2 = S2 + 1
2393 C GO TO 112
2394 213 IF(MARK1.EQ.5)RETURN
2395 C GO TO 107
2396 114 STORE = SVST(S2,2)
2397 C IF(STORE.EQ.0) GO TO 113
2398 C START = 0
2399 C TJTIME = 0
2400 C TOLY = 0

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2401      TOIST = 0
2402      IF (IPRINT.EQ.0) WRITE (6,1019)
2403      APL1 = SVOL(STORE,1)/100000
2404      AJ1 = SVOL(STORE,1) - 100000*APL1
2405      APL2 = SVOL(STORE,2)/100000
2406      AJ2 = SVOL(STORE,2) - 100000*APL2
2407      AS = SVOL(STORE,3)/100000
2408      AMSEC = SVOL(STORE,3) - 100000*AS
2409      AVEL = SVOL(STORE,4)/100000
2410      AT2 = SVOL(STORE,4) - 100000*AVEL
2411 115 NEXT = SVOL(STORE,S)
2412      IF(NEXT.EQ.0) GO TO 118
2413      BPL1 = SVOL(NEXT,1)/100000
2414      BJ1 = SVOL(NEXT,1) - 100000*BPL1
2415      BPL2 = SVOL(NEXT,2)/100000
2416      BJ2 = SVOL(NEXT,2) - 100000*BPL2
2417      BS = SVOL(NEXT,3)/100000
2418      BMSEC = SVOL(NEXT,3) - 100000*BS
2419      BVEL = SVOL(NEXT,4)/100000
2420      BT2 = SVOL(NEXT,4) - 100000*BVEL
2421      IF(SVOL(STORE,2).EQ.SVOL(NEXT,1)) GO TO 116
2422      WRITE(6,1033) APL2,JST(AJ2),BPL1,JST(BJ1)
2423 116 IF(START.EQ.5)GO TO 117
2424      IF (IPRINT) 18,19,18
2425      19 WRITE(6,1021)S2,AMSEC
2426      WRITE(6,1022)JST(AJ1)
2427      18 START = S
2428 117 OIST = LTH(BJ1)
2429      JTIME = BMSEC - AMSEC
2430      SOLY = BMSEC - AT2
2431      IF(SOLY.LT.0)SOLY=0
2432      TOIST = TOIST + OIST
2433      TOLY = TOLY + SOLY
2434      TJTIME = TJTIME + JTIME
2435      IF (IPRINT) 14,15,14
2436      15 WRITE(6,1023) JST(BJ1),JTIME,SOLY,OIST
2437      14 SVOL(STORE,S) = NOSN
2438      NOSN = STORE
2439      SVST(S2,2) = NEXT
2440      STORE = NEXT
2441      APL1 = BPL1
2442      AJ1 = BJ1
2443      APL2 = BPL2
2444      AJ2 = BJ2
2445      AS = BS
2446      AMSEC = BMSEC
2447      AVEL = BVEL
2448      AT2 = BT2
2449      GO TO 115
2450 118 IF (IPRINT) 16,17,16
2451      17 WRITE (6,1030)
2452      WRITE(6,1028) TJTIME,TOLY,TOIST,AMSEC
2453 C SVST(NM,9) HOLOS THE TOTAL BUS JOURNEY TIME FOR BUS JOURNEYS
2454 C OF TYPE NM.
2455 C SVST(NM,10) HOLOS THE SUM OF SQUARES OF BUS JOURNEY TIMES
2456 C FOR BUS JOURNEYS TYPE NM.
2457 C SVST(NM,11) HOLOS THE NUMBER OF BUS JOURNEYS OF TYPE NM.
2458      16 IF (MSEC - STRT) 123,123,122
2459      122 NM = SVST(S,8)
2460      SVST(NM,9) = SVST(NM,9) + TJTIME

2461      SVST(NM,10) = SVST(NM,10) + TJTIME*TJTIME
2462      SVST(NM,11) = SVST(NM,11) + 1
2463 123 IF(MARK.EQ.S) GO TO 113
2464      SVST(S,2) = 0
2465      SVST(S,3) = 0
2466      RETURN
2467 119 S2 = S
2468      MARK = 0
2469      GO TO 114
2470 70 RETURN
2471      ENTRY SPV3
2472      IF(N.EQ.0)RETURN
2473      MARK1=5
2474      WRITE(6,1020)MOST
2475      GO TO 111
2476 1034 FORMAT('0','VEHICLE',G10,'AT BUS STOP',G10,'IS NOT A BUS')
2477      ENTRY SVNO(B1,B2)
2478      AVEH=B1
2479      PL=B2
2480      S=1
2481 120 IF(AVEH.EQ.SVST(S,3))GO TO 121
2482      S=S+1
2483      IF(S.LE.N)GO TO 120
2484      WRITE(6,1034)AVEH,OST(PL)
2485      RETURN
2486 121 BUS=S
2487      RETURN
2488      ENO
2489      SUBROUTINE VACT
2490      IMPLICIT INTEGER(A-Z)
2491      INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
2492      INTEGER*4 JUN,OET,ENTRY,JST,EST,OST,CARS,OTCN,NSTOP,OUTDAT,COUT,
2493      1MLANE,BLANE,LTH,VELO,OETINT,
2494      2JNST,
2495      3MIN,MAX,EXTT,MINGT,MAXGT,NST,OEMOET,EXTOET,OEM,NOST
2496      INTEGER*4 SVDMOT(28,4,2),SVEXTT(28),SVEXT(28,4,6),SVOEM(28,4),
2497      1SVMXGT(28),SVMAX(28,4),EXTRGN(28,4),EXGN(28,4)
2498      REAL*8 TIM
2499      DIMENSION JUN(75,30),OET(120,15),DECTR(75),ENTRY(40,6),
2500      1JST(75),OST(120),EST(40),CARS(750,4),JTST(75),OTCN(75),
2501      2OLY(75),NSTOP(75),OUTOAT(12,3),COUT(S,2),
2502      3SATN(3),COUN(5),OCN(3),
2503      4TLST(28,23),JNST(28),CHANGE(28,2),
2504      5MLANE(6,8),BLANE(6,4),LTH(75),VELO(75),OETINT(120),
2505      6OUMJUN(4),MASTJN(4),
2506      7MIN(28,4),MAX(28,4),EXTT(28),MINGT(28),MAXGT(28),NST(28,4),
2507      8OEMOET(28,4,2),EXTOET(28,4,6),OEM(28,4),NOST(28)
2508      DIMENSION ICOMP(28),ICHOP(28),NNSKIP(28),IRUN(28),FST(28)
2509      COMMON JUN,OET,DECTR,ENTRY,JST,OST,EST,CARS,MSEC,
2510      1JTST,OTCN,OLY,NSTOP,OUTOAT,COUT,NOUT,NPER,
2511      2MLANE,BLANE,LTH,VELO,OETINT,BM,BUS
2512      COMMON/COM1/SATN,COUN,OCN,VLTH,
2513      1ENOT,RNGE,SPEED,NVEH,UCST,LCST,RN,OOELAY
2514      COMMON/COM2/TLST,JNST,CHANGE,HFACT,NOUM,OUMJUN,MASTJN,
2515      1MIN,MAX,EXTT,MINGT,MAXGT,NST,OEMOET,EXTOET,OEM,NOST,NJN,EXT
2516      COMMON /BLKCOMP/ SVDMOT,SVEXTT,SVEXT,SVMXGT,SVMAX,SVOEM,
2517      1 EXTRGN,EXGN,SVEXT,ICOMP,ICHOP,NNSKIP,IRUN,FST
2518      COMMON /BLKSVH/ SVST(100,11),SVOL(100,S),NSPVEH,START,
2519      1 SVSTRT(100),IPRINT
2520 C PROCESS JUNTIONS IN TURN

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2521      DO 20 JN = 1,NJN
2522      CHANGE(JN,1)=0
2523      CHANGE(JN,2)=0
2524      K = NDST(JN)
2525      C   FOR EACH STAGE FIND NO. OF VEHICLES WAITING
2526      DO 2 ST = 1,K
2527      DO 1 I = 1,2
2528      D=DEMDET(JN,ST,I)
2529      IF (D) 1,1,23
2530      23 DD = DETINT(D) - 100*(DETINT(D)/100)
2531      C   IF DO NOT WANT TO DETECT A QUEUE ADD NEXT STATEMENT.
2532      IF (DD.EQ.20) GO TO 1
2533      IF (DD.GT.0) DEM(JN,ST)=DEM(JN,ST)+DD
2534      1 CONTINUE
2535      2 CONTINUE
2536      RST = TLST(JN,1)
2537      C   IF JUNCTION IS IN INTERGREEN OR PRE-INTERGREEN NO CHANGE
2538      IF(RST.LT.0) GO TO 20
2539      IF(TLST(JN,2).LE.0) GO TO 20
2540      DEM(JN,RST) = 0
2541      C   IF THIS IS THE FIRST SECOND STAGE RUNNING SET MINIMUM GREEN TIMER
2542      IF (TLST(JN,2).NE.1) GO TO 4
2543      MINGT(JN) = MIN(JN,RST) - HFACT + 1
2544      4 NODEM = 0
2545      IF(MAXGT(JN).NE.0)GO TO 8
2546      TEMP = 0
2547      DO 5 ST = 1,K
2548      IF(DEM(JN,ST).GT.0) TEMP = TEMP + 1
2549      5 CONTINUE
2550      IF(TEMP.EQ.0) GO TO 6
2551      IF (EXTRGN(JN,RST)) 3,3,7
2552      3 MAXGT(JN) = MAX(JN,RST) + 1 - HFACT
2553      GO TO 8
2554      7 MAXGT(JN) = MAX(JN,RST) + EXTRGN(JN,RST) + 1 - HFACT
2555      GO TO 8
2556      6 NODEM = 1
2557      8 EXTT(JN) = EXTT(JN) - 1
2558      DO 9 I = 1,6
2559      O=EXTDET(JN,RST,I)
2560      IF(O.EQ.0)GO TO 9
2561      IF(DETINT(D).GT.0)GO TO 11
2562      9 CDNTINUE
2563      C   DECREMENT MINIMUM GREEN TIMER
2564      10 MINGT(JN) = MINGT(JN) - 1
2565      C   IF NO DEMAND THEN NODEM = 1 -NO CHANGE
2566      IF(NODEM.EQ.1) GO TO 20
2567      GO TO 13
2568      11 EXTT(JN)=EXT
2569      GO TO 10
2570      C   DECREMENT MAXIMUM GREEN TIMER
2571      13 MAXGT(JN) = MAXGT(JN) - 1
2572      C   IF MINIMUM GREEN UNEXPIRED -NO CHANGE
2573      IF (MINGT(JN).GT.0) GO TO 20
2574      C   IF MAXIMUM GREEN ELAPSED CHANGE = 2
2575      IF(MAXGT(JN).EQ.0) GO TO 12
2576      C   IF NO EXTENSION OUTSTANDING CHANGE = 1
2577      IF(EXTT(JN).LE.0) GO TO 14
2578      GO TO 20
2579      12 CHANGE(JN,2) = 2
2580      GO TO 15

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2581      14 CHANGE(JN,2) = 1
2582      C   CHANGE TO NEXT STAGE
2583      15 KK=K-1
2584      NEWST=RST
2585      DD 16 SST=1,KK
2586      NEWST=NST(JN,NEWST)
2587      IF (DEM(JN,NEWST)) 16,16,17
2588      16 CONTINUE
2589      17 CHANGE(JN,1)=NEWST
2590      IF (IPRINT) 18,19,18
2591      19 WRITE(6,100)MSEC,JNST(JN),CHANGE(JN,2),CHANGE(JN,1)
2592      100 FORMAT (' MSEC =',G5,' JUNCTION',G3,' CHANGE',G2,
2593      1 ' OCCURING STAGE =',G2)
2594      18 MINGT(JN)=0
2595      EXTT(JN)=0
2596      20 CONTINUE
2597      RETURN
2598      END
2599      SUBROUTINE DATA(N1,N2,N3,N4)
2600      C   N1=COUN(1), N2=COUN(2), N3=COUN(3), N4=COUN(5)
2601      IMPLICIT INTEGER(A-Z)
2602      INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
2603      REAL*4 SEDL,SEJT,SOAVJT,SODEL
2604      INTEGER*4 JUN,DET,ENTRY,JST,EST,DST,CARS,DTCN,NSTOP,OUTDAT,COUT,
2605      1MLANE,BLANE,LTH,VELO,DETINT,DCARS,HIST
2606      INTEGER*4 NGRN(28,4),NGREEN(28,4),GRNT(28,4),GREENT(28,4)
2607      INTEGER*4 FRCCNG(28,4,4),NSVEX(28,4,4),NWGP,NWMX,SVSTRT
2608      REAL CONV,ENTI(40)
2609      REAL*8 VMPH,VHPP,FLDW,B1,B2,AVJT,TJT,SUMFLD,SUMJT,AIN
2610      REAL*8 TIM
2611      DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
2612      1JST(75),DST(120),EST(40),CARS(750,4),JTST(75),DTCN(75),
2613      2DLY(75),NSTOP(75),OUTDAT(12,3),COUT(5,2),
2614      3SATN(3),COUN(5),OCN(3),
2615      4MLANE(6,8),BLANE(6,4),LTH(75),VELD(75),DETINT(120),
2616      5JTS(75),DRCN(75),DELAY(75),NSTP(75),JS(75),SODEL(75),
2617      6SOAVJT(75)
2618      CDMMDN JUN,DET,DECTR,ENTRY,JST,DST,EST,CARS,MSEC,
2619      1JTST,DTCN,DLY,NSTDP,OUTDAT,CDUT,NOUT,NPER,
2620      2MLANE,BLANE,LTH,VELD,DETINT,BM,BUS
2621      COMMON/CDM1/SATN,COUN,OCN,VLTH,
2622      1ENDT,RNGE,SPEED,NVEH,UCST,LCST,RN,ODELAY
2623      CDMMDN /BLKTIM/ PCHNGE(28),MNJN,NGRN,NGREEN,GRNT,GREENT
2624      CDMMDN /BLKSVH/ SVST(100,11),SVDL(100,5),NSPVEH,START,
2625      1 SVSTRT(100),IPRINT
2626      CDMMDN /BLKFCG/ FRCCNG,NSVEX,NWGP,NWMX
2627      CDMMDN /BLKHST/ DCARS(750),HIST(75,20),HSTINC
2628      CDMMDN /BLKI/ NSTRT(40),SUMN(40),SNSQ(40),TNSTRT(40),TSUMN(40),
2629      1 TSNSQ(40),NM(40)
2630      C -----
2631      1000 FORMAT (SG10)
2632      1001 FDRMAT('O','START DATA CDLECTION AT ',G6,' INCREMENT ',G6,
2633      1 ' INCREMENT FDR HISTOGRAM',I6)
2634      1002 FDRMAT(' ','ND DATA OUTPUT ASKED FOR')
2635      1003 FDRMAT('O','START TIME',G6,T20,'STOPLINE',T3S,'RUNNING TIME',TSO,
2636      1'DELAY',T6S,'STDPS',T81,'FLDW',T90,'JDURNEY TIME',T108,'AV.J-T')
2637      1004 FDRMAT(' ',T20,G6,T33,G10,T4S,G10,T60,G10,T75,G10,T90,G10,
2638      1T10S,F10.0,T120,F10.3)
2639      1005 FDRMAT('O','TIME',G8,T20,'STDPLINE',T3S,'RUNNING TIME',TSO,
2640      1'DELAY',T6S,'STOPS',T81,'FLDW',T93,'FLOW.OIST',T107,'JDURNEY TIME'

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2641      2,T124,'AV.J-T')
2642      1006 FORMAT('O',T20,'DECISION',T30,'INFLOW',T40,'OUTFLOW')
2643      1007 FORMAT(' ',T20,G6,2G10)
2644      1008 FORMAT('O',6X,'TOTAL INFLOW',G10,6X,'TOTAL OUTFLOW',G10)
2645      1009 FORMAT('O',T20,G10,' VEHICLES IN SYSTEM AT ',G6)
2646      1010 FORMAT('O',T20,'VEHICLE HOURS PER HOUR ',G20.10/
2647      1 ' ',T20,'VEHICLE KILOMETRES PER HOUR',G20.10)
2648      1011 FORMAT(G10)
2649      1012 FORMAT('1',T10,'DATA FOR ',G8,' SECONOS ENDING AT ',G8/'O',
2650      1'STOPLINE',T15,'AVERAGE JOURNEY',T32,'STANDARD',T45,
2651      2'FREE JOURNEY',T60,'DELAY SECONOS',T75,'STANDARD',T85,
2652      3'STOPS',T105,'FLOW VEHICLES',T125,'DISTANCE'/' ',T15,
2653      4'TIME X 1000',T32,'ERROR',T45,'TIME X 1000',T60
2654      5,'PER HOUR',T75,'ERROR',T85,'PER HOUR',T105,
2655      6'PER HOUR'//)
2656      1013 FORMAT (' ',G6,T13,G10,T28,G11.5,T44,G10,T60,G10,T72,G11.5,T80,
2657      1G10,T105,G10,T120,G10)
2658      1014 FORMAT('1',')
2659      1015 FORMAT(16G5)
2660      1016 FORMAT(24G5)
2661      1017 FORMAT(' ',INFLOW THIS PERIOD',G10,' OUTFLOW THIS PERIOD',G8)
2662      1020 FORMAT('O','FAULT IN DATA OUTPUT FOR JUNCTION ',G10//)
2663      1021 FORMAT('O',T20,'TOTALS FOR ',G6,' SPECIFIED LINKS',T90,F10.0,
2664      1T105,F10.0)
2665      1022 FORMAT('O',T20,'SCALED VALUES',T90,F10.2,' VKPH',T105,F10.2,
2666      1' VHPH')
2667      1023 FORMAT(' ',T20,G6,T33,G10,T45,G10,T60,G10,T75,G10,T90,F10.0,
2668      1T105,F10.3)
2669      1024 FORMAT (1H0,T45,'TOTAL GREEN TIME AND NUMBER OF TIMES GREEN')
2670      1025 FORMAT (' JUNCTION',T22,'STAGE',12,T47,'STAGE',12,T72,
2671      1 'STAGE',12,T97,'STAGE',12)
2672      1026 FORMAT (17,9X,4(2(15,5X),5X))
2673      1027 FORMAT (' BUS JOURNEY',13,4X,'NUMBER OF BUSES',14,4X,
2674      1 'AVERAGE JOURNEY TIME',G12.4,5X,'STANDARD ERROR',G12.4)
2675      1028 FORMAT (' JUNCTION',15,3X,'STAGE',13,5X,15,' GAP CHANGES'
2676      1,' OVERRIDEN',16,' SECONOS IN TOTAL',16,' MAX',15,
2677      1' SECONOS')
2678      1029 FORMAT (' JUNCTION',15,3X,'NUMBER OF FORCE CHANGES TO '
2679      1,'STAGE',13,' FROM STAGES 1 TO 4',416)
2680      1030 FORMAT ('HISTOGRAM DATA',/25X,'NUMBER OF VEHICLES DELAYED'
2681      1,' FOR LESS THAN',/'STOPLINE',3X,2016,/43X,'SECONOS')
2682      1031 FORMAT (17,5X,2016)
2683      C -----
2684      C READ O/P START TIME, INCREMENT AND NUMBER OF STOPLINES
2685      READ (5,1000) START,INCRM,N,HSTINC,IPRINT
2686      IF (HSTINC.LE.0) HSTINC = 2
2687      CONV = 3600/INCRM
2688      C READ STOPLINES NUMBERS
2689      DO 4 J=1,16
2690      M=16*(J-1)+1
2691      L=M+15
2692      READ(5,1015)(JS(I),I=M,L)
2693      IF(JS(16*J).EQ.0)GO TO 5
2694      4 CONTINUE
2695      5 WRITE(6,1001)START,INCRM,HSTINC
2696      MARK = 0
2697      C INITIALISE DATA STORES
2698      DO 1 I = 1,N1
2699      JTST(I) = 0
2700      OLY(I) = 0

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2701      OTCN(I) = 0
2702      NSTOP(I) = 0
2703      JTS(I) = 0
2704      DELAY(I) = 0
2705      ORCN(I) = 0
2706      NSTP(I) = 0
2707      SQDEL(I) = 0.0
2708      SQAVJT(I) = 0.0
2709      DO 1 I1 = 1,20
2710      HIST(I,I1) = 0
2711      1 CONTINUE
2712      DO 29 I = 1,750
2713      29 OCARS(I) = 0
2714      DO 6 I=1,NJN
2715      PCHNGE(I) = 0
2716      DO 6 ST=1,4
2717      NGRN(I,ST) = 0
2718      NGREEN(I,ST) = 0
2719      GRNT(I,ST) = 0
2720      DO 8 SST = 1,4
2721      FRCCNG(I,ST,SST) = 0
2722      8 NSVEX(I,ST,SST) = 0
2723      6 GREENT(I,ST) = 0
2724      DO 33 I=1,N3
2725      NSTRT(I) = 0
2726      SUMN(I) = 0
2727      SNSQ(I) = 0
2728      TNSTRT(I) = 0
2729      TSUMN(I) = 0
2730      TSNSQ(I) = 0
2731      33 NM(I) = 0
2732      PTIN = 0
2733      PTOUT = 0
2734      NMPER = 0
2735      NWGP = 0
2736      NWMX = 0
2737      CT = 0
2738      RETURN
2739      C -----
2740      2 WRITE(6,1002)
2741      C -----
2742      3 RETURN
2743      C -----
2744      9003 AVJT=0
2745      GO TO 9010
2746      C -----
2747      C PERIODIC O/P OF DATA FOR WHOLE NETWORK
2748      ENTRY 01
2749      C -----
2750      IF (INCRM.EQ.0) GO TO 3
2751      MARK = 0
2752      IF(MSEC-START) 3,10,20
2753      10 CT=0
2754      WRITE (6,1024)
2755      WRITE (6,1025) (I,I=1,4)
2756      DO 7 JN=1,NJN
2757      16 WRITE (6,1026) JN,(GREENT(JN,ST),NGREEN(JN,ST),ST=1,4)
2758      DO 7 I=1,4
2759      NGREEN(JN,I) = 0
2760      7 GREENT(JN,I) = 0

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2761 C O/P STOPLINE DELAY INFORMATION
2762 WRITE (6,1003) MSEC
2763 DO 11 I = 1,N1
2764 TJT = JTST(I) + DLY(I)
2765 IF(DTCN(I).EQ.0)GO TO 9003
2766 AVJT=TJT/DTCN(I)
2767 9010 WRITE(6,1023) JST(I),JTST(I),DLY(I),NSTDP(I),DTCN(I),TJT,AVJT
2768 JTST(I) = 0
2769 DLY(I) = 0
2770 DTCN(I) = 0
2771 NSTOP(I) = 0
2772 DD 11 I1 = 1,10
2773 HIST(I,I1) = 0
2774 11 CONTINUE
2775 DO 46 I = 1,N3
2776 TSNSO(I) = -SNSO(I)
2777 TSUMN(I) = -SUMN(I)
2778 46 TNSTRT(I) = -NSTRT(I)
2779 C -----
2780 12 WRITE(6,1006)
2781 C O/P INFLDW AND OUTFLOW INFORMATION
2782 INFLO = 0
2783 OUTFL = 0
2784 X = 0
2785 DO 13 I = 1,N3
2786 WRITE(6,1007) EST(I),ENTRY(I,6),X
2787 INFLO = INFLO + ENTRY(I,6)
2788 13 CDNTINUE
2789 L = N3+1
2790 U = N3+N4
2791 DO 14 I = L,U
2792 WRITE(6,1007) EST(I),X,ENTRY(I,6)
2793 OUTFL = OUTFL + ENTRY(I,6)
2794 14 CONTINUE
2795 IF(ENTRY(40,6).EQ.0)GO TO 15
2796 WRITE(6,1007)X,X,ENTRY(40,6)
2797 OUTFL = OUTFL + ENTRY(40,6)
2798 15 WRITE(6,1008) INFLO,OUTFL
2799 NI = INFLO-PTIN
2800 NO = OUTFL-PTOUT
2801 PTOUT = OUTFL
2802 PTIN = INFLO
2803 103 FORMAT ('NUMBER OF PERIODS FOR THE STANDARO ERRORS',15)
2804 WRITE(6,1017)NI,NO
2805 DIFFL = INFLO - OUTFL
2806 WRITE(6,1009) DIFFL,MSEC
2807 C CALCULATE I FOR THE ENTRY POINTS..
2808 DO 44 I=1,N3
2809 IF (SUMN(I)) 47,47,48
2810 48 ENTI(I) = (SNSO(I)*1.0*NSTRT(I)/SUMN(I)-SUMN(I))/(NSTRT(I)-1)
2811 TSNSO(I) = TSNSO(I) + SNSO(I)
2812 TSUMN(I) = TSUMN(I) + SUMN(I)
2813 47 TNSTRT(I) = TNSTRT(I) + NSTRT(I)
2814 SNSO(I) = 0
2815 SUMN(I) = 0
2816 44 NSTRT(I) = 0
2817 WRITE (6,41) (EST(I),ENTI(I),I=1,N3)
2818 41 FORMAT (' I VALUES FOR ENTRY POINTS',5X,8(17,F5.2))
2819 IF(MARK) 3,3,30
2820 C -----
2821 20 CT = CT+1
2822 IF(CT.NE.INCRM)GO TO 3
2823 CT = 0
2824 CALL GRAPH2
2825 21 CDNTINUE
2826 WRITE (6,1024)
2827 WRITE (6,1025) (I,I=1,4)
2828 DD 17 JN=1,NJN
2829 DO 18 I=1,4
2830 NGRN(JN,I) = NGRN(JN,I) + NGREEN(JN,I)
2831 18 GRNT(JN,I) = GRNT(JN,I) + GREENT(JN,I)
2832 WRITE (6,1026) JN,(GREENT(JN,ST),NGREEN(JN,ST),ST=1,4)
2833 DO 17 I=1,4
2834 NGREEN(JN,I) = 0
2835 17 GREENT(JN,I) = 0
2836 WRITE (6,1005) MSEC
2837 SUMFLO = 0
2838 SUMJT = 0
2839 DD 22 I = 1,N1
2840 TJT = JTST(I) + DLY(I)
2841 DFLDW = DTCN(I)*LTH(I)
2842 IF(DTCN(I).EQ.0) GD TO 8022
2843 AVJT = TJT/DTCN(I)
2844 SOAVJT(I) = SOAVJT(I) + TJT*TJT
2845 7021 WRITE(6,1004) JST(I),JTST(I),DLY(I),NSTDP(I),
2846 DTCN(I),DFLDW,TJT,AVJT
2847 DO 8021 PL=1,N
2848 IF(JS(PL).EQ.JST(I)) GD TO 9022
2849 8021 CDNTINUE
2850 9021 JTS(I) = JTS(I) + JTST(I)
2851 JTST(I) = 0
2852 IF(JTS(I).GT.1000000000) MARK = 2
2853 DELAY(I) = DELAY(I) + DLY(I)
2854 SODEL(I) = SODEL(I) + 1.000*DLY(I)*DLY(I)
2855 DLY(I) = 0
2856 IF(DELAY(I).GT.1000000000) MARK = 2
2857 NSTP(I) = NSTP(I) + NSTDP(I)
2858 NSTOP(I) = 0
2859 IF(NSTP(I).GT.1000000000) MARK = 2
2860 ORCN(I) = DRCN(I) + DTCN(I)
2861 DTCN(I) = 0
2862 IF(DRCN(I).GT.1000000000) MARK = 2
2863 22 CONTINUE
2864 WRITE(6,1021) N,SUMFLO,SUMJT
2865 C SCALE VALUES TO VEHICLE KM. PER HDUR AND VEHICLE HOURS PER HDUR
2866 SUMFLO = (SUMFLO*CDNV)/1000
2867 SUMJT = SUMJT/INCRM
2868 WRITE(6,1022) SUMFLO,SUMJT
2869 NMPER = NMPER + 1
2870 GO TO 12
2871 8022 AVJT = 0
2872 GO TO 7021
2873 9022 SUMFLO = SUMFLO + DFLDW
2874 SUMJT = SUMJT + TJT
2875 GD TO 9021
2876 C -----
2877 ENTRY D2
2878 C -----
2879 IF(INCRM.EQ.0) GD TO 3
2880 MARK = 1

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2881      GO TO 21
2882      C -----
2883      30 TIMD = MSEC - START
2884      WRITE(6,1012) TIMD,MSEC
2885      START = MSEC + 500
2886      MARK6=0
2887      VMPH = 0.0
2888      VHPH = 0.0
2889      DD 37 I = 1,N
2890      DD 31 PL = 1,N1
2891      IF(JS(I).EQ.JST(PL)) GO TO 32
2892      31 CONTINUE
2893      9031 WRITE(6,1020) JS(I)
2894      IF(MARK6.EQ.1)GO TO 37
2895      WRITE(6,1016)(JST(J),J=1,24)
2896      MARK6=1
2897      GO TO 37
2898      32 DIST=LTH(PL)
2899      VEL=VELD(PL)
2900      JTS(PL) = JTS(PL) + DELAY(PL)
2901      IF (NMPER - 1) 100,100,101
2902      101 SEJT = FLDAT(JTS(PL))
2903      SEJT = (SOAVJT(PL) - SEJT*SEJT/NMPER)/(NMPER*(NMPER-1))
2904      SEJT = SORT(SEJT)*1000./DRCN(PL)
2905      SEDL = FLDAT(DELAY(PL))
2906      SEDL = (SODEL(PL) - SEDL*SEDL/NMPER)/(NMPER*(NMPER-1))
2907      SEDL = SORT(SEDL)*3600.0*NMPER/TIMD
2908      GO TO 102
2909      100 SEJT = 0
2910      SEDL = 0
2911      102 B1=(JTS(PL)*3600.)/TIMD-(((DRCN(PL)*3600.)/TIMD)*DIST)/VEL
2912      DELAY(PL) = B1
2913      B1 = JTS(PL)
2914      B2 = TIMD
2915      VHPH = VHPH + B1/B2
2916      JTS(PL) = (JTS(PL)*1000)/DRCN(PL)
2917      JT1 = (DIST*1000)/VEL
2918      NSTP(PL) = (NSTP(PL)*3600)/TIMD
2919      DRCN(PL) = (DRCN(PL)*3600)/TIMD
2920      FLDW = DRCN(PL)
2921      B2 = DIST
2922      VMPH = VMPH + (B2*FLDW)/(1000.0)
2923      WRITE (6,1013) JST(PL),JTS(PL),SEJT,JT1,DELAY(PL),SEDL,
2924      1 NSTP(PL),DRCN(PL),DIST
2925      37 CONTINUE
2926      WRITE (6,103) NMPER
2927      38 DD 40 I = 1,N1
2928      JTS(I) = 0
2929      DELAY(I) = 0
2930      DRCN(I) = 0
2931      NSTP(I) = 0
2932      40 CONTINUE
2933      WRITE(6,1010) VHPH,VMPH
2934      WRITE (6,1024)
2935      WRITE (6,1025) (I,I=1,4)
2936      25 WRITE (6,1026) (JN,(GRNT(JN,ST),NGRN(JN,ST),ST=1,4),JN=1,NJN)
2937      C  DUTPUT SUMMARIES FOR SPECIAL VEHICLES.
2938      IF (NSPVEH) 112,112,114
2939      114 WRITE (6,1007)
2940      DD 110 I=1,NSPVEH

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2941      IF (SVST(I,11)) 111,111,110
2942      110 CONTINUE
2943      GO TO 112
2944      111 I = I - 1
2945      DD 113 II = 1,I
2946      AIN = FLDAT(SVST(II,11))
2947      SEDL = FLDAT(SVST(II,9))
2948      SEJT = SEDL/AIN
2949      SEDL = (FLDAT(SVST(II,10)) - SEDL*SEDL/AIN)/(AIN*(AIN-1.0))
2950      SEDL = SORT(SEDL)
2951      WRITE (6,1027) II,SVST(II,11),SEJT,SEDL
2952      113 CONTINUE
2953      C  DUTPUT DETAILS OF SELECTIVE VEHICLE OPERATION.
2954      DD 9 I=1,NJN
2955      DD 24 J=1,4
2956      DD 19 K=1,3,2
2957      IF (NSVEX(I,J,K)) 19,19,23
2958      19 CONTINUE
2959      GO TO 24
2960      23 WRITE (6,1028) I,J,(NSVEX(I,J,K),K=1,4)
2961      24 CONTINUE
2962      DD 26 J=1,4
2963      DD 27 K=1,4
2964      IF (FRCCNG(I,K,J)) 27,27,28
2965      27 CONTINUE
2966      GO TO 26
2967      28 WRITE (6,1029) I,J,(FRCCNG(I,K,J),K=1,4)
2968      26 CONTINUE
2969      9 CONTINUE
2970      DD 200 I = 1,20
2971      200 DCARS(I) = HSTINC * I
2972      WRITE (6,1030) (DCARS(I),I = 1,20)
2973      DD 201 I = 1,N
2974      DD 202 PL = 1,N1
2975      IF (JS(I) = JST(PL)) 202,203,202
2976      203 WRITE (6,1031) JS(I),(HIST(PL,II),II = 1,20)
2977      202 CONTINUE
2978      201 CONTINUE
2979      DD 42 I=1,N3
2980      42 ENTI(I) = (TSNSQ(I)*1.0*TNSTRT(I)/TSUMN(I)-TSUMN(I))/(TNSTRT(I)-1)
2981      WRITE (6,41) (EST(I),ENTI(I),I=1,N3)
2982      112 WRITE (6,1014)
2983      RETURN
2984      END
2985      SUBROUTINE SVREAD(NDEMD)
2986      IMPLICIT INTEGER(A-Z)
2987      INTEGER*4 MSEC, JTST, NDUT, NPER, BM, BUS
2988      INTEGER*4 INST(100),EX(4),MX(4)
2989      INTEGER*4 JUN,DET,ENTRY,JST,EST,DST,CARS,DTCN,NSTDP,DUTDAT,CDUT,
2990      1MLANE,BLANE,LTH,VELD,DETINT,
2991      2JNST,
2992      3MIN,MAX,EXTT,MINGT,MAXGT,NST,DEMDDET,EXTDET,DEM,NDST
2993      INTEGER*4 SVDMDT(28,4,2),SVEXTT(28),SVEXTD(28,4,6),SVDEM(28,4),
2994      1SVMXGT(28),SVMAX(28,4),EXTRCN(28,4),EXGN(28,4)
2995      REAL*8 TIM
2996      DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
2997      1JST(75),DST(120),EST(40),CARS(750,4),JTST(75),DTCN(75),
2998      2DLV(75),NSTDP(75),DUTDAT(12,3),CDUT(5,2),
2999      3SATN(3),CDUN(5),QCN(3),
3000      4TLST(28,23),JNST(28),CHANGE(28,2),

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3001      SMLANE(6,8),BLANE(6,4),LTH(75),VELD(75),DETINT(120),
3002      6DUMJUN(4),MASTJN(4),
3003      7MIN(28,4),MAX(28,4),EXTT(28),MINGT(28),MAXGT(28),NST(28,4),
3004      8DEMDET(26,4,2),EXTDET(28,4,6),DEM(28,4),NDST(28)
3005      DIMENSION ICDMP(28),ICHDP(28),NNSKIP(28),IRUN(28),FST(28)
3006      CDMMDN JUN,DET,DECTR,ENTRY,JST,DST,EST,CARS,MSEC,
3007      1JTST,DTCN,DLY,NSTDP,DUTDAT,CDUT,NDUT,NPER,
3008      2MLANE,BLANE,LTH,VELD,DETINT,BM,BUS
3009      CDMMDN/CDM1/SATN,CDUN,OCN,VLTH,
3010      1ENDT,RNGE,SPEED,NVEH,UCST,LCST,RN,ODELAY
3011      CDMMDN/CDM2/TLST,JNST,CHANGE,HFACT,NDUM,DUMJUN,MASTJN,
3012      1MIN,MAX,EXTT,MINGT,MAXGT,NST,DEMDET,EXTDET,DEM,NDST,NJN,EXT
3013      CDMMDN /BLKCMF/ SVDMDT,SVEXTT,SVEXDT,SVMXGT,SVMAX,SVDEM,
3014      1 EXTRGN,EXGN,SVEXT,ICDMP,ICHDP,NNSKIP,IRUN,FST
3015      IXX=0
3016      DD 100 I=1,28
3017      DD 102 J=1,4
3018      EXTRGN(I,J) = 0
3019      102 SVDEM(I,J) = 0
3020      SVEXTT(I) = 0
3021      SVMXGT(I) = 0
3022      ICDMP(I) = 0
3023      ICHDP(I) = 0
3024      NNSKIP(I) = 0
3025      IRUN(I) = 0
3026      100 CONTINUE
3027      DD 12 I=1,NJN
3028      J=JNST(I)
3029      12 INST(J)=1
3030      C READ IN EXTENSION PRODUCED BY S.V. DETECTORS.
3031      READ (5,30) SVEXT,NDEMD
3032      WRITE (6,31) SVEXT,NDEMD
3033      DD 1 I=1,NJN
3034      DD 8 J=1,4
3035      EXGN(I,J)=0
3036      8 SVMAX(I,J)=0
3037      C READ IN EXTERNAL JUNCTION ND., FIRST STAGE, AND
3038      C EXTRA GREEN AND SV MAX GREEN DF 4 STAGES.
3039      READ (5,2) JN,FS,(EX(J),J=1,4),(MX(J),J=1,4)
3040      JJN=INST(JN)
3041      FST(JJN)=FS
3042      DD 3 J=1,4
3043      IF (EX(J)) 10,10,9
3044      9 IF (EX(J) - 120) 10,10,5
3045      10 EXGN(JJN,J)=EX(J)
3046      IF (MX(J)) 5,3,11
3047      11 IF (MX(J) - 240) 3,3,S
3048      3 SVMAX(JJN,J)=MX(J)
3049      GD TD 7
3050      5 WRITE (6,13) JN,FS,(EX(J),J=1,4),(MX(J),J=1,4)
3051      IXX=1
3052      C READ IN EXTERNAL NDS. DF SV DEMAND AND EXTEND DETECTORS.
3053      7 READ (5,15) ((SVDMDT(JJN,L,K),K=1,2),(SVEXDT(JJN,L,K),
3054      1 K=1,6),L=1,4)
3055      1 CONTINUE
3056      WRITE (6,16)
3057      WRITE (6,17) (JNST(JN),FST(JN),(EXGN(JN,J),J=1,4),(SVMAX
3058      1 (JN,J),J=1,4),JN=1,NJN)
3059      WRITE (6,18)
3060      WRITE (6,20)
3061      WRITE (6,19) (JNST(JN),((SVDMDT(JN,L,K),K=1,2),(SVEXDT(JN
3062      1 ,L,K),K=1,6),L=1,4),JN=1,NJN)
3063      C CDVERT DETECTORS TO INTERNAL NDS.
3064      NDETR=CDUN(2)
3065      DD 6 JN=1,NJN
3066      DD 21 ST=1,4
3067      DD 22 I=1,2
3068      A=SVDMDT(JN,ST,1)
3069      DD 23 J=1,NDETR
3070      IF (DST(J)-A) 23,24,23
3071      23 CONTINUE
3072      GD TD 22
3073      24 SVDMDT(JN,ST,1)=J
3074      22 CONTINUE
3075      DD 25 I=1,6
3076      A=SVEXDT(JN,ST,1)
3077      DD 26 J=1,NDETR
3078      IF (DST(J)-A) 26,27,26
3079      26 CONTINUE
3080      GD TD 25
3081      27 SVEXDT(JN,ST,1)=J
3082      25 CONTINUE
3083      21 CONTINUE
3084      6 CONTINUE
3085      IF (IXX) 4,4,14
3086      4 RETURN
3087      14 STOP
3088      2 FDRMAT (10IS)
3089      15 FDRMAT (16IS)
3090      13 FDRMAT (' ***** ERRDR IN S.V. DATA ',10IS)
3091      16 FDRMAT (' OJUNCTION FIRST STAGE EXTRA GREEN ',
3092      1 ' SVMAX GREEN')
3093      17 FDRMAT (17,110,7X,413,4X,413)
3094      18 FDRMAT (' OSV DETECTORS')
3095      19 FDRMAT ((15,8X,2(2X,21S,18,S15),/,13X,2(2X,21S,18,S15)))
3096      20 FDRMAT (' OJUNCTION',9X,' DEMAND',14X,' EXTEND',16X,' DEMAND'
3097      1,15X,' EXTEND')
3098      30 FDRMAT (21S)
3099      31 FDRMAT (' S.V. EXTENSION =',15,' NUMBER OF DEMAND '
3100      1,' DETECTORS =',13)
3101      END
3102      SUBROUTINE TREAD
3103      IMPLICIT INTEGER(A-Z)
3104      INTEGER*4 MSEC, JTST, NDUT, NPER, BM, BUS
3105      INTEGER*4 JUN,DET,ENTRY,JST,EST,DST,CARS,DTCN,NSTDP,DUTDAT,CDUT,
3106      1MLANE,BLANE,LTH,VELD,DETINT,
3107      2JNST,
3108      3STST,ARM,STN
3109      REAL*8 TIM
3110      C*** SEE BELDW IF DIMENSIONS OF TLST OR JNST ARE CHANGED.
3111      DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
3112      1JST(75),DST(120),EST(40),CARS(750,4),JTST(75),DTCN(75),
3113      2DLY(75),NSTDP(75),DUTDAT(12,3),CDUT(5,2),
3114      3SATN(3),CDUN(5),OCN(3),
3115      4TLST(28,23),JNST(28),CHANGE(28,2),
3116      5MLANE(6,8),BLANE(6,4),LTH(75),VELD(75),DETINT(120),
3117      6STST(28,4),ARM(4),DUMJUN(4),MASTJN(4),
3118      7MIN(28,4),MAX(28,4),EXTT(28),MINGT(28),MAXGT(28),NST(28,4),
3119      8DEMDET(28,4,2),EXTDET(28,4,6),DEM(28,4),NDST(28)
3120      CDMMDN JUN,DET,DECTR,ENTRY,JST,DST,EST,CARS,MSEC,

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3121      1JTST,OTCN,OLY,NSTOP,OUTDAT,COUT,NDUT,NPER,
3122      2MLANE,BLANE,LTH,VELO,DETINT,BM,BUS
3123      COMMON/COM1/SATN,COUN,QCN,VLTH,
3124      1ENOT,RNGE,SPEED,NVEH,UCST,LCST,RN,QOELAY
3125      COMMON/COM2/TLST,JNST,CHANGE,HFACT,NOUM,DUMJUN,MASTJN,
3126      1MIN,MAX,EXTT,MINGT,MAXGT,NST,OEMDET,EXTDET,OEM,NOST,NJN,EXT
3127      1000 FORMAT(13G5)
3128      1010 FORMAT(' HFACT',I5)
3129      1001 FORMAT(20G4)
3130      1002 FORMAT('O','FAULT IN TREA01. STN=',G5,' JN=',G5)
3131      1003 FORMAT('O','JUNCTION SIGNAL DATA')
3132      1004 FORMAT('O',' ',G3,4G5,T47,' ',G3,4G5,T91,' ',G3,4G5)
3133      1005 FORMAT(' ',G4,7G5,T47,G4,7G5,T91,G4,7G5)
3134      1006 FORMAT(' ', 'FAULT IN TPRINT1.JN=',G5,' COUN(4)=' ,G5)
3135      1007 FORMAT('O',' ')
3136      1008 FORMAT('O','FAULT IN TREA02. JNND=',G5,' PLN=',G5,' CYCL=',G5,
3137      1' COUN(4)=' ,G5)
3138      1009 FORMAT('O','FAULT IN TREA02. STN=',G5,' JN=',G5)
3139      1017 FORMAT('O','FAULT IN TREA01.UNRESOLVED STOPLINE NO=',G5,' JN',G5)
3140      1018 FORMAT('O','JNST(JN) LISTING FOR JN=1 UP TO JN=',G2)
3141      1019 FORMAT(' ',2G10)
3142      1021 FORMAT('O','ERROR IN DUMMY JN. DATA DUMJUN=',G5)
3143      1022 FORMAT('O','ERROR IN DUMMY JN. DATA MASTJN=',G5)
3144      C
3145      C START OF READ JUNCTION SIGNAL DATA ROUTINE ( TREA01)
3146      READ(5,1001)COUN(4),T,HFACT,NOUM
3147      IF(NOUM.EQ.0)GO TO 500
3148      DO 50 JN=1,NOUM
3149      READ(5,1001)DUMJUN(JN),MASTJN(JN)
3150      50 CONTINUE
3151      C T=2 FOR JNST LISTING WITH JN NUMBERS. OTHERWISE T=0
3152      C**** ZERO ALL TLST AND JNST. ** CHANGE THE UPPER LIMIT
3153      C ON THE DO LOOP IF DIMENSIONS ARE CHANGED. THIS IS BECAUSE
3154      C THE UNSET ELEMENTS OF TLST MAY BE REFERENCED BEFORE THE
3155      C WRITE STATEMENTS.
3156      C****
3157      500 DO 2 JN=1,28
3158      DO 1 WD=1,23
3159      TLST(JN,WD) = 0
3160      1 CONTINUE
3161      JNST(JN) = 0
3162      2 CONTINUE
3163      P = COUN(4)
3164      DO 9 JN=1,P
3165      READ(5,1001)JNST(JN),ARM(1),ARM(2),ARM(3),ARM(4),STST(JN,1),
3166      1TLST(JN,20),STST(JN,2),TLST(JN,21),STST(JN,3),TLST(JN,22),
3167      2STST(JN,4),TLST(JN,23)
3168      C
3169      C CONVERT EXTERNAL ARM NUMBERS TO INTERNAL PL TYPE DECISION NUMBERS
3170      DO 40 J= 1,4
3171      X = COUN(1)
3172      IF(ARM(J).EQ.0) GO TO 40
3173      TEST = ARM(J)
3174      DO 38 I=1,X
3175      IF(TEST.EQ.JST(I)) GO TO 39
3176      38 CONTINUE
3177      WRITE(6,1017) TEST,JN
3178      STOP
3179      39 ARM(J) = I
3180      40 CONTINUE

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3181      READ(5,1001) STA,AA1,MA1,AA2,MA2,STB,AB1,AB2,MB2,
3182      1STC,AC1,MC1,AC2,MC2,STO,A01,M01,A02,M02
3183      STN = STA
3184      A1 = AA1
3185      M1 = MA1
3186      A2 = AA2
3187      M2 = MA2
3188      JB = 1
3189      GO TO 6
3190      3 STN = STB
3191      A1 = AB1
3192      M1 = MB1
3193      A2 = AB2
3194      M2 = MB2
3195      JB = 2
3196      GO TO 6
3197      4 STN = STC
3198      A1 = AC1
3199      M1 = MC1
3200      A2 = AC2
3201      M2 = MC2
3202      JB = 3
3203      GO TO 6
3204      5 STN = STO
3205      A1 = A01
3206      M1 = M01
3207      A2 = A02
3208      M2 = M02
3209      JB = 4
3210      6 IF(STN.EQ.0) GO TO 9
3211      DO 7 ST=1,4
3212      IF(STN.EQ.STST(JN,ST)) GO TO 8
3213      7 CONTINUE
3214      WRITE(6,1002) STN,JN
3215      STOP
3216      8 Q = ST*4
3217      IF(A1.EQ.0)GO TO 907
3218      TLST(JN,Q) = ARM(A1)
3219      TLST(JN,Q+1) = M1
3220      907 IF(A2.EQ.0) GO TO 908
3221      TLST(JN,Q+2) = ARM(A2)
3222      TLST(JN,Q+3) = M2
3223      908 GO TO ( 3, 4, 5) ,JB
3224      9 CONTINUE
3225      C
3226      IF(NOUM.EQ.0)GO TO 511
3227      DO 51 J=1,NOUM
3228      TEST=DUMJUN(I)
3229      DO 52 JN=1,P
3230      IF(TEST.EQ.JNST(JN))GO TO 53
3231      52 CONTINUE
3232      WRITE(6,1021)DUMJUN(I)
3233      STOP
3234      53 DUMJUN(I)=JN
3235      TEST=MASTJN(I)
3236      DO 54 JN=1,P
3237      IF(TEST.EQ.JNST(JN))GO TO 55
3238      54 CONTINUE
3239      WRITE(6,1022)MASTJN(I)
3240      STOP

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3241      55 MASTJN(1)=JN
3242      51 CONTINUE
3243      C      START OF TPRINT1 ROUTINE
3244      511 IF(T.NE.2) GO TO 910
3245      WRITE(6,1018) COUN(4)
3246      DO 999 JN=1,P
3247      WRITE(6,1019) JN,JNST(JN)
3248      999 CONTINUE
3249      910 JN = 1
3250      C      THIS INDIRECT METHOD OF PRINTING JNST(JN+1) IS TO BYPASS
3251      C      COMPILER TROUBLES IN THE 4-70 J800 SYSTEM      JAN 1970
3252      K = JN-2
3253      WRITE(6,1003)
3254      WRITE (6,1010) HFACT
3255      JN = 1
3256      10 K = JN-2
3257      WRITE(6,1004)JNST(JN),(TLST(JN,N),N=20,23),JNST(K+3),
3258      1(TLST(JN+1,N),N=20,23),JNST(JN+2),(TLST(JN+2,N),N=20,23)
3259      A1 = TLST(JN,4)
3260      A2 = TLST(JN,6)
3261      B1 = TLST(JN,8)
3262      B2 = TLST(JN,10)
3263      C1 = TLST(JN+1,4)
3264      C2 = TLST(JN+1,6)
3265      D1 = TLST(JN+1,8)
3266      D2 = TLST(JN+1,10)
3267      E1 = TLST(JN+2,4)
3268      E2 = TLST(JN+2,6)
3269      F1 = TLST(JN+2,8)
3270      F2 = TLST(JN+2,10)
3271      WRITE(6,1005)JST(A1),TLST(JN,5),JST(A2),TLST(JN,7),JST(B1),
3272      1TLST(JN,9),JST(B2),TLST(JN,11),JST(C1),TLST(JN+1,5),JST(C2),
3273      2TLST(JN+1,7),JST(D1),TLST(JN+1,9),JST(D2),TLST(JN+1,11),JST(E1),
3274      3TLST(JN+2,5),JST(E2),TLST(JN+2,7),JST(F1),TLST(JN+2,9),JST(F2),
3275      4TLST(JN+2,11)
3276      A1 = TLST(JN,12)
3277      A2 = TLST(JN,14)
3278      B1 = TLST(JN,16)
3279      B2 = TLST(JN,18)
3280      C1 = TLST(JN+1,12)
3281      C2 = TLST(JN+1,14)
3282      D1 = TLST(JN+1,16)
3283      D2 = TLST(JN+1,18)
3284      E1 = TLST(JN+2,12)
3285      E2 = TLST(JN+2,14)
3286      F1 = TLST(JN+2,16)
3287      F2 = TLST(JN+2,18)
3288      WRITE(6,1005)JST(A1),TLST(JN,13),JST(A2),TLST(JN,15),JST(B1),
3289      1TLST(JN,17),JST(B2),TLST(JN,19),JST(C1),TLST(JN+1,13),JST(C2),
3290      2TLST(JN+1,15),JST(D1),TLST(JN+1,17),JST(D2),TLST(JN+1,19),JST(E1),
3291      3TLST(JN+2,13),JST(E2),TLST(JN+2,15),JST(F1),TLST(JN+2,17),JST(F2),
3292      4TLST(JN+2,19)
3293      JN = JN + 3
3294      IF((JN+2).LE.COUN(4)) GO TO 10
3295      IF(JN.GT.COUN(4)) GO TO 912
3296      IF(JN.EQ.COUN(4)) GO TO 11
3297      IF(COUN(4).EQ.(JN+1)) GO TO 12
3298      WRITE(6,1006) JN,COUN(4)
3299      STOP
3300      11 WRITE(6,1004) JNST(JN),(TLST(JN,N),N=20,23)

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3301      A1 = TLST(JN,4)
3302      A2 = TLST(JN,6)
3303      B1 = TLST(JN,8)
3304      B2 = TLST(JN,10)
3305      WRITE(6,1005)JST(A1),TLST(JN,5),JST(A2),TLST(JN,7),JST(B1),
3306      1TLST(JN,9),JST(B2),TLST(JN,11)
3307      A1 = TLST(JN,12)
3308      A2 = TLST(JN,14)
3309      B1 = TLST(JN,16)
3310      B2 = TLST(JN,18)
3311      WRITE(6,1005)JST(A1),TLST(JN,13),JST(A2),TLST(JN,15),JST(B1),
3312      1TLST(JN,17),JST(B2),TLST(JN,19)
3313      GO TO 912
3314      12 K = JN-2
3315      WRITE(6,1004) JNST(JN),(TLST(JN,N),N=20,23),JNST(K+3),
3316      1(TLST(JN+1,N),N=20,23)
3317      A1 = TLST(JN,4)
3318      A2 = TLST(JN,6)
3319      B1 = TLST(JN,8)
3320      B2 = TLST(JN,10)
3321      C1 = TLST(JN+1,4)
3322      C2 = TLST(JN+1,6)
3323      D1 = TLST(JN+1,8)
3324      D2 = TLST(JN+1,10)
3325      WRITE(6,1005)JST(A1),TLST(JN,5),JST(A2),TLST(JN,7),JST(B1),
3326      1TLST(JN,9),JST(B2),TLST(JN,11),JST(C1),TLST(JN+1,5),JST(C2),
3327      2TLST(JN+1,7),JST(D1),TLST(JN+1,9),JST(D2),TLST(JN+1,11)
3328      A1 = TLST(JN,12)
3329      A2 = TLST(JN,14)
3330      B1 = TLST(JN,16)
3331      B2 = TLST(JN,18)
3332      C1 = TLST(JN+1,12)
3333      C2 = TLST(JN+1,14)
3334      D1 = TLST(JN+1,16)
3335      D2 = TLST(JN+1,18)
3336      WRITE(6,1005)JST(A1),TLST(JN,13),JST(A2),TLST(JN,15),JST(B1),
3337      1TLST(JN,17),JST(B2),TLST(JN,19),JST(C1),TLST(JN+1,13),JST(C2),
3338      2TLST(JN+1,15),JST(D1),TLST(JN+1,17),JST(D2),TLST(JN+1,19)
3339      912 RETURN
3340      ENO
3341      SUBROUTINE VAREAD
3342      IMPLICIT INTEGER(A-Z)
3343      INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
3344      INTEGER*4 JUN, OET, ENTRY, JST, EST, OST, CARS, OTCN, NSTOP, OUTOAT, COUT,
3345      1MLANE, BLANE, LTH, VELO, OETINT,
3346      2JNST,
3347      3MIN, MAX, EXTT, MINGT, MAXGT, NST, OEMOET, EXTOET, OEM, NOST, A
3348      REAL*8 TIM
3349      DIMENSION JUN(75,30), OET(120,15), DECTR(75), ENTRY(40,6),
3350      1JST(75), OST(120), EST(40), CARS(750,4), JTST(75), OTCN(75),
3351      2DLY(75), NSTOP(75), OUTOAT(12,3), COUT(5,2),
3352      3SATN(3), COUN(5), OCN(3),
3353      4TLST(28,23), JNST(28), CHANGE(28,2),
3354      5MLANE(6,8), BLANE(6,4), LTH(75), VELO(75), OETINT(120),
3355      6DUMJUN(4), MASTJN(4),
3356      7MIN(28,4), MAX(28,4), EXTT(28), MINGT(28), MAXGT(28), NST(28,4),
3357      8OEMOET(28,4,2), EXTOET(28,4,6), DEM(28,4), NOST(28), A(13)
3358      COMMON JUN, OET, DECTR, ENTRY, JST, OST, EST, CARS, MSEC,
3359      1JTST, OTCN, DLY, NSTOP, OUTOAT, COUT, NOUT, NPER,
3360      2MLANE, BLANE, LTH, VELO, OETINT, BM, BUS

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3361      CDMMDN/CDM1/SATN,CDUN,OCN,VLTH,
3362      IENDT,RNGE,SPEED,NVEH,UCST,LCST,RN,ODELAY
3363      CDMMDN/CDM2/TLST,JNST,CHANGE,HFACT,NDUM,DUMJUN,MASTJN,
3364      IMIN,MAX,EXTT,MINGT,MAXGT,NST,DEMDT,EXTDET,DEM,NDST,NJN,EXT
3365      READ(S,1000)NJN,EXT
3366      WRITE (6,1200) EXT
3367      1200 FDMAT (' V.A. EXTENSION = ',IS)
3368      DO 33 T = 1,NJN
3369      READ(S,1000) J,(A(I),I=1,13)
3370      DO 30 JN = 1,NJN
3371      IF(J.EQ.JNST(JN)) GO TO 31
3372      30 CONTINUE
3373      WRITE(6,100) J
3374      31 NDST(JN) = A(1)
3375      DO 32 ST = 1,4
3376      NST(JN,ST)=A(ST+1)
3377      MIN(JN,ST)=A(ST+5)
3378      MAX(JN,ST)=A(ST+9)
3379      32 CONTINUE
3380      READ(S,1000)(DEMDT(JN,1,1),I=1,2),(EXTDET(JN,1,1),I=1,6),
3381      1(DEMDT(JN,2,1),I=1,2),(EXTDET(JN,2,1),I=1,6)
3382      READ(S,1000)(DEMDT(JN,3,1),I=1,2),(EXTDET(JN,3,1),I=1,6),
3383      1(DEMDT(JN,4,1),I=1,2),(EXTDET(JN,4,1),I=1,6)
3384      33 CONTINUE
3385      1000 FDMAT(16GS)
3386      100 FDMAT(' ','ERRDR IN DATA JUNCTIDN NUMBER',GS)
3387      DD934 JN = 1,NJN
3388      P = NDST(JN)
3389      WRITE(6,101) JNST(JN),NDST(JN)
3390      DO 934 ST=1,P
3391      WRITE(6,102) MIN(JN,ST),MAX(JN,ST),(DEMDT(JN,ST,1),I=1,2),
3392      1(EXTDET(JN,ST,1),I=1,6)
3393      934 CONTINUE
3394      101 FDMAT(' ','*',G10,'*',G10)
3395      102 FDMAT(' ',2GS,10X,2GS,10X,6GS)
3396      D = CDUN(2)
3397      103 FDMAT(' ','ERRDR IN VAREAD DATA      JUN = ',GS,'DET',GS)
3398      DD 40 JN = 1,NJN
3399      P=NDST(JN)
3400      DD 40 ST = 1,P
3401      DD 36 I = 1,2
3402      DE=DEMDT(JN,ST,1)
3403      IF(DE.EQ.0)GO TO 36
3404      DD 34 PL = 1,D
3405      IF(DE.EQ.DST(PL))GO TO 35
3406      34 CONTINUE
3407      WRITE(6,103)JNST(JN),DE
3408      35 DEMDT(JN,ST,1) = PL
3409      36 CONTINUE
3410      DD 39 I = 1,6
3411      DE=EXTDET(JN,ST,1)
3412      IF(DE.EQ.0)GO TO 39
3413      DD 37 PL = 1,D
3414      IF(DE.EQ.DST(PL))GO TO 36
3415      37 CONTINUE
3416      WRITE(6,103)JNST(JN),DE
3417      38 EXTDET(JN,ST,1) = PL
3418      39 CONTINUE
3419      40 CONTINUE
3420      NNJN = CDUN(4)

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3421      DD 45 JN=1,NNJN
3422      DO 44 STX=1,4
3423      DD 43 I=1,3,2
3424      O=(STX*4-1)+1
3425      ARM=TLST(JN,O)
3426      IF(ARM.EQ.0)GO TO 43
3427      LN=TLST(JN,O+1)
3428      IF((LN.EQ.1).DR.(LN.EQ.3).DR.(LN.EQ.5).
3429      1DR.(LN.EQ.7))GO TO 46
3430      41 IF((LN.EQ.2).DR.(LN.EQ.3).DR.(LN.EQ.6).
3431      1DR.(LN.EQ.7))GO TO 47
3432      42 IF((LN.EQ.4).AND.(LN.LE.7))GO TO 48
3433      43 CONTINUE
3434      44 CONTINUE
3435      TLST(JN,1)=-1
3436      TLST(JN,2)=0
3437      TLST(JN,3)=-999
3438      45 CONTINUE
3439      DD 50 JN=1,NJN
3440      MAXGT(JN)=0
3441      MINGT(JN)=0
3442      EXTT(JN)=0
3443      DD 49 ST=1,4
3444      DEM(JN,ST)=0
3445      49 CONTINUE
3446      50 CONTINUE
3447      RETURN
3448      46 IF(JUN(ARM,12).LT.0)GO TO 41
3449      JUN(ARM,12)=-JUN(ARM,12)
3450      GO TO 41
3451      47 IF(JUN(ARM,13).LT.0)GO TO 42
3452      JUN(ARM,13)=-JUN(ARM,13)
3453      GO TO 42
3454      48 IF(JUN(ARM,14).LT.0)GO TO 43
3455      JUN(ARM,14)=-JUN(ARM,14)
3456      GO TO 43
3457      END
3458      SUBROUTINE ENDJDB
3459      IMPLICIT INTEGER(A-Y)
3460      INTEGER*4 MSEC, JTST, NDUT, NPER, BM, BUS, TTIM
3461      INTEGER*4 JUN,DET,ENTRY,JST,EST,DST,CARS,DTCN,NSTOP,DUTDAT,COUT,
3462      1MLANE,BLANE,LTH,VELO,DETINT
3463      REAL*8 TIM
3464      DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
3465      1JST(75),DST(120),EST(40),CARS(750,4),JTST(75),DTCN(75),
3466      2DLY(75),NSTDP(75),DUTDAT(12,3),COUT(5,2),
3467      3SATN(3),CDUN(5),OCN(3),
3468      4MLANE(6,8),BLANE(6,4),LTH(75),VELD(75),DETINT(120)
3469      CDMMDN JUN,DET,DECTR,ENTRY,JST,DST,EST,CARS,MSEC,
3470      1JTST,DTCN,DLY,NSTDP,DUTDAT,COUT,NDUT,NPER,
3471      2MLANE,BLANE,LTH,VELO,DETINT,BM,BUS
3472      CDMMDN/CDM1/SATN,CDUN,OCN,VLTH,
3473      IENDT,RNGE,SPEED,NVEH,UCST,LCST,RN,ODELAY
3474      1000 FORMAT('O',' ')
3475      1001 FORMAT('O','PROGRAM PREMATURELY TERMINATED BY TYPEWRITER AT ',G8,
3476      1' ',END TIME SHOULD HAVE BEEN ',G8)
3477      1002 FDMAT('O','MAXIMUM NUMBER OF VEHICLES USED SO FAR IS ',G8)
3478      1003 FDMAT('O','CCAE3 END DATA')
3479      1004 FORMAT('O','REMAINING SPECIAL VEHICLE DATA')
3480      1005 FDMAT('O','OTHER MISCELLANEOUS DATA')

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3481 1006 FORMAT('O',T10,'END OF DATA OUTPUT',' ',T10,'-----')
3482 1---')
3483 1007 FORMAT(' ',G10.1)
3484 1008 FORMAT('O','NO MORE CARS AVAILABLE FOR INPUT. ENO-TIME = ',G8)
3485 WRITE(6,1000)
3486 C CALL CDMENT('R05IM9')
3487 GO TO 1
3488 ENTRY ENOP
3489 WRITE(6,1008) MSEC
3490 C CALL CDMENT('R05IM8')
3491 GO TO 2
3492 1 WRITE(6,1001) MSEC,ENOT
3493 WRITE(6,1002) LCST
3494 C 2 CALL CLDCK(TIM)
3495 C WRITE(6,1007) TIM
3496 2 WRITE(6,1000)
3497 WRITE(6,1004)
3498 CALL SPV3
3499 WRITE(6,1005)
3500 CALL D2
3501 WRITE(6,1006)
3502 CALL EXIT
3503 STOP
3504 END
3505 SUBROUTINE GRAPH5(N)
3506 N=NUMBER OF STOPLINES
3507 C IMPLICIT INTEGER(A-Z)
3508 INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
3509 REAL BLANK,DNE,SYMBOL,LINE,ACCDEL
3510 INTEGER*4 JUN,OET,ENTRY,JST,EST,DST,CARS,DTCN
3511 DIMENSION JUN(75,30),OET(120,15),DECTR(75),ENTRY(40,6),
3512 1JST(75),DST(120),EST(40),CARS(750,4),JTST(75),DTCN(75),
3513 2DLY(75),PD5(5),DAT(5),SCALE(5),GRAPH(5,75),DL(75),LINE(125),
3514 3ACC(5),ACCDEL(5)
3515 COMMON JUN,OET,DECTR,ENTRY,JST,DST,EST,CARS,MSEC,
3516 1JTST,DTCN,DLY,NSTOP,OUTOAT,CDUT,NOUT,NPER,
3517 2MLANE,BLANE,LTH,VELD,DETINT,BM,BUS
3518 READ(5,1002) STT,EOT,INCR
3519 IF(STT.EQ.0)GO TO 59
3520 GRAPE5=1
3521 READ(5,1002)(GRAPH(X,1),X=1,5)
3522 DO 55 X = 1,5
3523 ACC(X)=0
3524 ACCDEL(X)=0
3525 IF (GRAPH(X,1).EQ.0)GO TO 55
3526 IF (GRAPH(X,1).EQ.9999) GO TO 55
3527 IF (GRAPH(X,1).GT.0) GO TO 56
3528 NUM = -GRAPH(X,1)
3529 MARK=NUM+1
3530 K=2
3531 50 L=K+15
3532 IF(L.GE.NUM+1)GO TO 51
3533 READ(5,1003) (GRAPH(X,M),M=K,L)
3534 K = L + 1
3535 GO TO 50
3536 56 DO 57 5L =1,N
3537 IF(GRAPH(X,1).EQ.JST(5L)) GO TO 58
3538 57 CONTINUE
3539 WRITE(6,1005)GRAPH(X,1)
3540 58 GRAPH(X,1) = 5L

```

```

3541 GO TO 55
3542 51 READ(5,1003) (GRAPH(X,M),M=K,MARK)
3543 DO 54 M=2,MARK
3544 TEST=GRAPH(X,M)
3545 IF(TEST.EQ.0)GO TO 54
3546 DO 52 5L =1,N
3547 IF(TEST.EQ.JST(5L)) GO TO 53
3548 52 CONTINUE
3549 WRITE(6,1005)GRAPH(X,M)
3550 1005 FDMAT('O','ERROR IN GRAPH INPUT STOPLINE NUMBER',G5)
3551 53 GRAPH(X,M) = 5L
3552 54 CONTINUE
3553 55 CONTINUE
3554 READ(5,1003) (PD5(I),DAT(I),SCALE(I),I=1,5)
3555 READ(5,100) BLANK,DNE,SYMBOL
3556 100 FORMAT(3A1)
3557 GO TO 1
3558 59 GRAPE5=0
3559 1 RETURN
3560 C-----
3561 ENTRY GRAPH1
3562 IF(GRAPE5.EQ.0)GO TO 1
3563 IF(MSEC-STT)1,2,5
3564 2 WRITE(6,1004)MSEC
3565 1004 FORMAT('1','GRAPHICAL DUTPUT STARTED MSEC = ',G6)
3566 DO 902 I=1,5
3567 IF(GRAPH(I,1))903,902,905
3568 905 IF(GRAPH(I,1).EQ.9999)GO TO 904
3569 J=GRAPH(I,1)
3570 WRITE(6,1007)1,JST(J),PD5(I),DAT(I),SCALE(I)
3571 1007 FDMAT(' ','GRAPH',G1,' STOPLINE NO.',G4,' POSITION = ',G4,
3572 1' DATUM = ',G5,' SCALE = ',G5)
3573 GO TO 902
3574 904 WRITE(6,1008)1,PD5(I),DAT(I),SCALE(I)
3575 1008 FDMAT(' ','GRAPH',G1,' ALL STOPLINES POSITION = ',G4,
3576 1' DATUM = ',G5,' SCALE = ',G5)
3577 GO TO 902
3578 903 NUM=-GRAPH(I,1)
3579 WRITE(6,1009)1,NUM,PD5(I),DAT(I),SCALE(I)
3580 1009 FDMAT(' ','GRAPH',G1,G5,' STOPLINES POSITION = ',G4,
3581 1' DATUM = ',G5,' SCALE = ',G5)
3582 902 CONTINUE
3583 PR = STT
3584 3 PR = PR + INCR
3585 DO 4 I =1,N
3586 OL(I) = DLY(I)
3587 4 CONTINUE
3588 GO TO 1
3589 5 IF(MSEC.NE.PR)GO TO 1
3590 DO 6 I =1,N
3591 TEMP =DLY(I) - DL(I)
3592 DL(I) = TEMP
3593 6 CONTINUE
3594 DO 11 I = 1,5
3595 TEMP = GRAPH(I,1)
3596 IF(TEMP)8,11,7
3597 7 IF(TEMP.EQ.9999) GO TO 10
3598 ACC(I) = OL(TEMP)
3599 GO TO 11
3600 8 NUM=-GRAPH(I,1)

```



```

3601 MARK=NUM+1
3602 DO 9 J=2,MARK
3603 TEMP = GRAPH(I,J)
3604 ACC(I) = ACC(I) + OL(TEMP)
3605 9 CONTINUE
3606 GO TO 11
3607 10 DO 910 J=1,N
3608 ACC(I) = ACC(I) + OL(J)
3609 910 CONTINUE
3610 11 CONTINUE
3611 DO 12 I = 1,5
3612 ACCOEL(I)=ACCDL(I)+ACC(I)
3613 IF(ACC(I).EQ.0)GO TO 12
3614 ACC(I)=ACC(I)-(DAT(I)*INCR)
3615 TEMP=SCALE(I)*INCR
3616 ACC(I)=(ACC(I)*10)/TEMP
3617 TEMP = ACC(I) - (ACC(I)/10)*10
3618 ACC(I) = ACC(I)/10
3619 IF(TEMP.GE.5)ACC(I) = ACC(I) +1
3620 IF(ACC(I).LT.0)ACC(I) = 0
3621 12 CONTINUE
3622 DO 13 I = 1,5
3623 IF(PDS(I).EQ.0)GO TO 13
3624 TEMP = PDS(I)
3625 LINE(TEMP) = DNE
3626 IF(ACC(I).EQ.0)GO TO 13
3627 TEMP1 = PDS(I) + ACC(I)
3628 MARK=TEMP+1
3629 DO 912 J=MARK,TEMP1
3630 LINE(J) = SYMBDL
3631 912 CONTINUE
3632 13 CONTINUE
3633 WRITE(6,1000) MSEC,LINE
3634 1000 FDMAT(' ',G7,12SA1)
3635 DO 14 I = 1,125
3636 LINE(I)=BLANK
3637 14 CONTINUE
3638 DO 15 I = 1,5
3639 ACC(I) = 0
3640 15 CONTINUE
3641 IF(PR.LT.EOT)GO TO 3
3642 TEMP=MSEC-STT
3643 DO 16 I=1,5
3644 ACCOEL(I)=ACCDL(I)/TEMP
3645 16 CONTINUE
3646 WRITE(6,1006){ACCOEL(I),I=1,5}
3647 1006 FDMAT(' ', 'AVERAGE DELAY IN VEH PER SEC IS',5F10.2)
3648 GRAPES=0
3649 GO TO 1
3650 1002 FDMAT(5G10)
3651 1003 FDMAT(16G5)
3652 C-----
3653 ENTRY GRAPH2
3654 IF(GRAPES.EQ.0)GO TO 1
3655 DO 60 I = 1,N
3656 TEMP = DLY(I)-DL(I)
3657 DL(I)=-TEMP
3658 60 CONTINUE
3659 GO TO 1
3660 C-----

```

```

3661 ENO
3662 SUBROUTINE DUT(A1,A2,A3)
3663 IMPLICIT INTEGER (A-Z)
3664 INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS
3665 INTEGER*4 JUN,DET,ENTRY,JST,EST,DST,CARS,DTCN,NSTDP,DUTOAT,COUT,
3666 1MLANE,BLANE,LTH,VELD,OETINT
3667 REAL*8 TIM
3668 DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
3669 1JST(75),OST(120),EST(40),CARS(750,4),JTST(75),DTCN(75),
3670 2DLY(75),NSTOP(75),OUTDAT(12,3),COUT(5,2),
3671 3SATN(3),CDUN(5),OCN(3),
3672 4MLANE(6,8),BLANE(6,4),LTH(75),VELO(75),OETINT(120)
3673 COMMON JUN,OET,DECTR,ENTRY,JST,OST,EST,CARS,MSEC,
3674 1JTST,DTCN,DLY,NSTDP,DUTDAT,COUT,NOUT,NPER,
3675 2MLANE,BLANE,LTH,VELD,OETINT,BM,BUS
3676 COMMON/CDM1/SATN,CDUN,OCN,VLTH,
3677 1ENOT,RNGE,SPEED,NVEH,UCST,LCST,RN,OOELAY
3678 C DUT( CARS,DECISION TYPE, DECISION NUMBER)
3679 C DECISION PDINT NUMBERS MUST BE IN INTERNAL PL FDM
3680 1000 FDMAT(' ', 'STOPL',3G5,12G4, ' **')
3681 1001 FDMAT(' ')
3682 1002 FDMAT(' ', 'OETR ',3G5,2G8,G12,T72, '**')
3683 1007 FDMAT(' ',T76,5G5)
3684 1008 FDMAT(' ', 'OUMP DF UNUSED CAR STORE')
3685 I = A1
3686 C I = 1 FOR PRINT OF VEHICLE LIST FOR THIS DECISION PDINT, OR I=0
3687 J = A2
3688 C J = 1 FOR STOPLINE DECISION PDINT J = 2 FOR DETECTOR
3689 K = A3
3690 IF(I.EQ.2) GO TO 10
3691 IF(J-2) 3,5,1
3692 1 RETURN
3693 3 WRITE(6,1000) JST(K),JUN(K,1),JUN(K,2),(JUN(K,N),N=9,14),
3694 1(JUN(K,N),N=23,28)
3695 C RETURN IF VEHICLE LIST NOT REQUESTED
3696 IF(I.EQ.0) GO TO 1
3697 C PRINT LIST OF VEHICLES AT STOPLINE
3698 IF(JUN(K,1).EQ.0) GO TO 1
3699 K = JUN(K,1)
3700 4 WRITE(6,1007) K,(CARS(K,N),N=1,4)
3701 K = CARS(K,4)
3702 IF(K.EQ.0) GO TO 1
3703 IF(CARS(K,3).EQ.0) GO TO 1
3704 GO TO 4
3705 5 WRITE(6,1002)OST(K),(DET(K,T),T=1,2),(DET(K,T),T=6,7),OETINT(K)
3706 IF(I.EQ.0) GO TO 1
3707 C PRINT LIST OF VEHICLES AT DETECTOR
3708 IF(OET(K,1).EQ.0) GO TO 1
3709 K = DET(K,1)
3710 GO TO 4
3711 C OUMP UNUSED CAR STORE, K = UCST
3712 10 WRITE(6,1008)
3713 11 WRITE(6,1007) K,(CARS(K,1),I=1,4)
3714 K = CARS(K,4)
3715 IF(K.EQ.0) GO TO 1
3716 GO TO 11
3717 END
3718 SUBROUTINE VARFLO(NOCHT)
3719 IMPLICIT INTEGER (A-Z)
3720 INTEGER*4 MSEC, JTST, NOUT, NPER, BM, BUS

```



```

3721      INTEGER*4 JUN,DET,ENTRY,JST,EST,DST,CARS,DTCN,NSTDP,DUTDAT,CDUT,
3722      1MLANE,BLANE,LTH,VELD,DETINT,
3723      2CHENT,CHADEL,CHADER
3724      DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
3725      1JST(75),DST(120),EST(40),CARS(750,4),JTST(75),DTCN(75),
3726      2DLY(75),NSTDP(75),DUTDAT(12,3),CDUT(5,2),
3727      3SATN(3),CDUN(5),OCN(3),
3728      4MLANE(6,8),BLANE(6,4),LTH(75),VELD(75),DETINT(120),
3729      5TIMCH(4),NDCHE(4),NDCHD(4),CHENT(40,4),CHADEL(120,4),
3730      6CHADER(120,4)
3731      COMMON JUN,DET,DECTR,ENTRY,JST,DST,EST,CARS,MSEC,
3732      1JTST,DTCN,DLY,NSTDP,DUTDAT,CDUT,NDUT,NPER,
3733      2MLANE,BLANE,LTH,VELD,DETINT,BM,BUS
3734      COMMON/CDM1/SATN,CDUN,OCN,VLTH,
3735      1ENDT,RNGE,SPEED,NVEH,UCST,LCST,RN,ODELAY
3736      COMMON /BLKFLD/ CHND,TIMCH,CHENT,CHADEL,CHADER,NDCHTT
3737      999 FDMAT(4G10)
3738      NDCHTT = NDCHT
3739      IF(NDCHT.EQ.0) GD TD 12
3740      CHND = 1
3741      P = CDUN(3)
3742      L = CDUN(2)
3743      READ(5,999)(TIMCH(I),I=1,4)
3744      DD 10 I = 1,4
3745      IF(TIMCH(1).EQ.0)GD TD 10
3746      READ(5,999)NDCHE(1),NDCHD(1)
3747      NDCH1 = NDCHE(1)
3748      NDCH2 = NDCHD(1)
3749      DD 1 M=1,P
3750      CHENT(M,1) = ENTRY(M,3)
3751      1 CONTINUE
3752      IF(NDCH1.EQ.0) GD TD 5
3753      DD 4 J=1,NDCH1
3754      READ(5,999) EP,VAL
3755      DD 2 K=1,P
3756      IF(EP.EQ.EST(K)) GD TD 3
3757      2 CONTINUE
3758      WRITE(6,1000)EP
3759      1000 FDMAT(' ','ERRDR IN VARFLC DATA ENTRY PDINT ND.',G5)
3760      3 VAL = VAL*10
3761      Z = VAL/36 + 0.5
3762      VAL=Z
3763      VAL = VAL*10
3764      CHENT(K,1) = VAL
3765      4 CONTINUE
3766      DD 6 PL=1,L
3767      CHADEL(PL,1)=DET(PL,8)
3768      CHADER(PL,1)=DET(PL,9)
3769      6 CONTINUE
3770      IF(NDCHD(1).EQ.0)GD TD 10
3771      DD 9 J=1,NDCH2
3772      READ(5,999)DP,VALL,VALR
3773      DD 7 K=1,L
3774      IF(DP.EQ.DST(K))GD TD 8
3775      7 CONTINUE
3776      WRITE(6,1001) DP
3777      1001 FDMAT(' ','ERRDR IN VARFLD DATA DETECTOR ND.',G5)
3778      8 CHADEL(K,1) = VALL*10
3779      CHADER(K,1) = VALR*10
3780      9 CONTINUE

```

```

3781      10 CONTINUE
3782      11 RETURN
3783      12 CHND = 0
3784      RETURN
3785      END
3786      SUBROUTINE FLDCH
3787      IMPLICIT INTEGER (A-Z)
3788      INTEGER*4 MSEC, JTST, NDUT, NPER, BM, BUS
3789      INTEGER*4 JUN,DET,ENTRY,JST,EST,DST,CARS,DTCN,NSTDP,DUTDAT,CDUT,
3790      1MLANE,BLANE,LTH,VELD,DETINT,CHENT,CHADEL,CHADER
3791      DIMENSION JUN(75,30),DET(120,15),DECTR(75),ENTRY(40,6),
3792      1JST(75),DST(120),EST(40),CARS(750,4),JTST(75),DTCN(75),
3793      2DLY(75),NSTDP(75),DUTDAT(12,3),CDUT(5,2),
3794      3SATN(3),CDUN(5),OCN(3),
3795      4MLANE(6,8),BLANE(6,4),LTH(75),VELD(75),DETINT(120),
3796      5TIMCH(4),NDCHE(4),NDCHD(4),CHENT(40,4),CHADEL(120,4),
3797      6CHADER(120,4)
3798      COMMON JUN,DET,DECTR,ENTRY,JST,DST,EST,CARS,MSEC,
3799      1JTST,DTCN,DLY,NSTDP,DUTDAT,CDUT,NDUT,NPER,
3800      2MLANE,BLANE,LTH,VELD,DETINT,BM,BUS
3801      COMMON/COM1/SATN,CDUN,OCN,VLTH,
3802      1ENDT,RNGE,SPEED,NVEH,UCST,LCST,RN,ODELAY
3803      COMMON /BLKFLD/ CHND,TIMCH,CHENT,CHADEL,CHADER,NDCHTT
3804      1002 FDMAT(' ','CHANGE DF FLOW PATTERN ND.',G3,'MSEC =',G7)
3805      1003 FDMAT(' ',2G7)
3806      1004 FDMAT('O','NEW ENTRY INFLDW VALUES')
3807      1005 FDMAT('O','NEW TURNING PERCENTAGES')
3808      1006 FDMAT(' ',3G7)
3809      IF(CHND.EQ.0) GD TD 11
3810      IF(MSEC.NE.TIMCH(CHND)) GD TD 11
3811      WRITE(6,1002)CHND,MSEC
3812      WRITE(6,1004)
3813      P = CDUN(3)
3814      L = CDUN(2)
3815      DD 13 I = 1,P
3816      ENTRY(1,3) = CHENT(1,CHND)
3817      WRITE(6,1003)EST(1),ENTRY(1,3)
3818      13 CONTINUE
3819      WRITE(6,1005)
3820      DD 14 I = 1,L
3821      DET(1,8) = CHADEL(1,CHND)
3822      DET(1,9) = CHADER(1,CHND)
3823      WRITE(6,1006)DST(1),DET(1,8),DET(1,9)
3824      14 CONTINUE
3825      CHND = CHND + 1
3826      IF(CHND.GT.NDCHTT) CHND = 2
3827      GD TD 11
3828      12 CHND = 0
3829      11 RETURN
3830      END

```

END DF FILE

APPENDIX V

Notes on the *BUSPAS* Input Data

NOTES ON DATA INPUT TO ROSIM

GENERAL

The traffic network to be studied is represented as a set of decision points by directed links.

There are four basic types of decision points

- a) stopline
- b) detector
- c) entry point
- d) exit point

The detector points are subdivided into five types, giving eight different types of decision point. Decision points are given a type code to differentiate between them.

Type Code

- | | |
|---|--|
| 1 | Stoplines |
| 2 | Ordinary Detectors - detect all vehicles |
| 3 | Entry points |
| 4 | Exit points |
| 5 | Bus Detectors - detect buses only |
| 6 | Bus stops (detector) - impede buses |
| 7 | Bus split detectors - divide the flow into two streams
directing buses down a bus lane |
| 8 | Movement split detectors - divide the flow into 2 or 3
streams, directing vehicles along the appropriate lane,
accordingly to the direction they will take at the next
stopline |

N. B. Types 6, 7, 8 do not detect vehicles.

There are some restrictions on the order of the decision points viz

- (a) A stopline may be followed by
 - (i) an exit point
 - (ii) a detector
- (b) A detector may be followed by
 - (i) a detector
 - (ii) a stopline
- (c) An entry point must be followed by a detector
- (d) An exit point has no following decision point

Since it is possible for a detector to follow another detector, some care must be taken as to the order in which the detectors are specified at input, as this is the order in which they will be processed each second.

If detector B directly follows detector A

(A) —————> (B)

then detector B must be specified before detector A, at input. This is to avoid processing a vehicle twice in the same second.

Junctions are controlled by traffic lights, and up to four stoplines may be specified for each junction. If more than four stoplines are required to obey the same traffic signals at a junction, a dummy junction must be included, which will control the additional stoplines. The stoplines controlled, movements and intergreens at each stage must be specified, as with any other junction in the Traffic Signal Control Data. In addition, this dummy junction with its corresponding Master Junction must be specified at input, in the DUMJUN and MASTJN arrays.

DATA INPUT

The following data must be supplied at input.

Stopline data

Detector data

Entry point data

Exit point data

Varflo data* - only if required

Network parameters

'OUT' data

Traffic light data

Fixed time signal data or control data

Special vehicle data

'DATA' output data

'GRAPHS' output data - if no graphical output then 1 blank card, otherwise
see 'GRAPHS' notes

STOPLINE DATA

Punched in G10 format

Last digit
in column

- | | |
|----|--|
| 10 | Number of stoplines in the network. |
| 20 | Set to $\emptyset$ if no printout for JUN, DET, and ENTRY is required. |
| 30 | Speed which movement propogates down a queue. |

Subsequent cards: 4 cards per stopline.

Last digit
in column

CARD 1

- | | |
|----|---|
| 10 | This stopline number. |
| 20 | Opposing stopline number - need only be specified if vehicles at the opposing stopline should impede the left turners at this stopline. |
| 30 | The number of left turners which may be released from this stopline during the first second of intergreen. |
| 40 | The distance in meters, between this stopline and the preceding stopline. Set to $\emptyset$ if no preceding stopline. |
| 50 | The average velocity, in km/hr, along the link leading to this stopline. |

Cards 2, 3, 4 give data concerning the next sublink and the decision point in the through, left and right directions respectively.

Last digit
in column

CARDS 2(3, 4)

- | | |
|----|--|
| 10 | Next decision point number in through (left, right) direction. |
| 20 | Saturation flow in vehs/hr, for vehicles leaving this stopline in through (left, right) direction. |
- If a combined saturation flow is required for two or three movements, the combined saturation flow is placed in the position corresponding to the first movement and the other movements are referenced to it.

eg. If the saturation flow for each movement is 1000 veh/hr and if () indicates combined, the appropriate values in the 2, 3 and 4th cards for the different situations should be

(T) 2nd card (L) 3rd Card (R) 4th Card

T,L,R	1000	1000	1000
(TL)R	2000	-1	1000
(TLR)	3000	-1	-1
T(LR)	1000	2000	-2
L(TR)	2000	1000	-1

- 30 The number of lanes on the sublink between this stopline and the next point in the through (left, right) direction.
- 40 The average velocity in km/hr, along the next link in the through (left, right) direction.
- 50 Distance, in metres, between this stopline and the next decision point in the through (left, right) direction.

DETECTOR DATA

Punched in G10 format

1st card: Number of detectors in the network

Subsequent cards:

1 card per detector - all types

1 additional card per detector - types 7 and 8 only

following first card

Detector Data sheet

Last digit
in column

10	detector number
20	next decision point number (in through direction for type 8) (in ord. vehicle div. for type 7)
30	distance, in metres, between this detector and the next decision point.
40	number of lanes on sublink between this detector and next decision point.
50	10 x (percentage of the vehicles passing over this detector which should turn left at the next stopline).
60	10 x (percentage of the vehicles passing over this detector which should turn right at the next stopline).
70	Type code of this detector (2, 5, 6, 7 or 8)
80	Type code of next decision point (1, 2, 5, 6, 7 or 8)

(Additional) Detector Data Sheet

(a) Bus split detectors

last digit
in column

- 10 Next decision point number along bus only lane
- 20 Type of the next decision point along bus lane
- 30 Distance in metres between this detector and the next decision pt.
 along bus lane.
- 40 Number of lanes on sublink between this detector and the next decision
 point along bus lane.

(b) Movement Split detectors

last digit
in column

- 10 (50) Next decision point along left (right) lane
- 20 (60) Type of the decision put along left(right) lane
- 30 (70) Distance, in metres, between this detector and the next decision
 point along left (right) lane.
- 40 (80) Number of lanes on sub link between this detector and the next decision
 pt along left (right) lane. *

ENTRY POINT DATA

Punched in G10 format

Last digit
in column

- | | |
|----|--|
| 10 | Number of Entry points in the network. |
| 20 | The number of times the flow pattern is to be changed.
See VARFLO data if required. |

Subsequent cards: 1 card per Entry point.

Last digit
in column

- | | |
|----|--|
| 10 | Entry point number. |
| 20 | Flow in veh/hr at entry point. |
| 30 | Number of the detector to which this entry point leads. |
| 40 | Time taken in secs (usually zero if entry point is on boundary
of network) before vehicles entering reach the next detector. |

EXIT POINT DATA

Punched in G10 format

First card: Number of exit points.

Subsequent cards: 1 card per 8 Exit points.

A list of the numbers of the exit points is required.

VARFLO DATA (REQUIRED ONLY IF NECESSARY)

A facility whereby at different times during a simulation run, the flow pattern may be changed has been incorporated into ROSIM.

The flow pattern may be changed up to four times. Both the inflow rates at Entry Points and the percentage turning movements at stoplines may be changed.

If it is wished to change flow pattern, then the following data must be submitted.

- (i) On the first card of the Entry Data, the number of times it is desired to change flow pattern (0-4) must be given.

i.e the first card of Entry Data should now read:

Column Ending

10 The number of Entry Points in the network

20 The number of times the flow pattern is to be changed.

- (ii) The following cards should be submitted after the EXIT data.

Column Ending CARD 1

10 (20, 30, 40) The time in seconds that the 1st (2nd, 3rd, 4th) change of flows should occur.

CARD A

10 The number of Entry Points at which the inflow rate is to be changed.

20 The number of detectors at which the percentage turning movements are to be changed.

CARD B

The number of cards type B which are submitted should be the number specified on card A. If no Entry Points are to be changed then no cards type B are required.

10 The Entry Point Number

20 The new value of the Entry flow in vehs/hour.

CARD C

The number of cards type C which are submitted should be the number specified on Card A. If no Detector tuning movements are to be changed, then no cards need to be submitted.

10 The detector no.

20 The new value of the percentage number of vehicles turning left x 10.

30 The new value of the percentage number of vehicles turning right x 10.

NB. If no change is specified at a detector or entry point, then the value in the original entry and detector data is assumed. NOT the value specified in the previous change.

NETWORK PARAMETERS

Punched in G10 format

Last digit
in column

1st card

10 Vehicle length, in metres. Average space occupied by a stationary, (queued) vehicle - usually taken to be 6 metres.

20 End Time. The time in secs at which the simulation run should terminate.

30 Velocity range - defines the range over which vehicles can have a velocity and is such that if M.S. is the mean speed on a link

$$\left(1 - \frac{VR}{100}\right) MS \leq \text{veh vel} \leq MS \left(1 + \frac{VR}{100}\right)$$

40 The speed, in km/hr, given to all vehicles when they first enter the network (ie before they reach a stopline)

2nd card

10 Any seven figure number - the random number generator seed.

3rd card

10 The maximum number of vehicles which are allowed in the network at any one time.

'OUT' DATA

If no 'OUT' output is required, a blank card is submitted.

This routine, for specified decision points (stoplines or detectors only), and for specified time periods, outputs each second, information relating to the decision point, and to the vehicles at the decision point.

Last digit
in column

FIRST CARD (G10 format)

- | | |
|------------|--|
| 10 | The number of periods (up to 3) at which time 'OUT' output is required. |
| 20 | The number of decision points for which information is required. |
| 30 (50,70) | The time, in seconds at which 'OUT' output should start for the 1st (2nd, 3rd) period. |
| 40 (60,80) | The time, in seconds, at which 'OUT' output should stop for the 1st (2nd, 3rd) period. |

SECOND CARD (G4 format)

- | | |
|----|--|
| 4 | Marker = 1 if a print out of the vehicles at the decision point is required 0 otherwise. |
| 8 | Type of this decision point 1 = stopline, 2 = detector (any type) |
| 12 | Decision point number |

The other decision points for which 'OUT' output is required are specified similarly on the same card.

TRAFFIC LIGHT AND JUNCTION DATA

Punched in G4 format

First Card

Last digit
in column

- 4 The number of junctions (including dummy junctions) in the network.
- 8 Marker = 2 if a listing of the junctions with their internal numbers is required $\emptyset$ otherwise.
- 12 Shift of green. The delay required between calling and implementing a change of stage.
- 16 The number of dummy junctions in the network.

Following cards : Dummy junction data

1 card per dummy junction (no cards if no dummy jns.)

- 4 Dummy junction Number
- 8 Corresponding master junction number.

Subsequent cards

2 cards per junction (including dummy junctions). On the 1st of these cards, the stoplines (4 at most) which the traffic signals at this junction control, the stage numbers (4 stages at most) and the intergreen periods are specified.

- 4 Junction Number

8(12; 16, 20) Arm 1 (2, 3, 4) - the number of the 1st (2nd, 3rd, 4th) stopline over which the traffic light at the junction has control.

24(32, 40, 48) The stage numbers

28(36,44,52) The length of the intergreen period in seconds, which precedes the stage specified in 24th (32, 40, 48) place.

Card 2 contains information relating to the stages. For each stage it specifies which arms are green (2 at most) and in which direction vehicles leaving the stopline can depart - it is thus possible to allow rightturners (say) to leave a stopline while stopping through and left turning vehicles.

4 The stage number

8(16) The arm number (1, 2, 3, or 4 which relates to the stopline numbers specified on card 1) over which vehicles can pass during this stage.

12(20) A code, signifying the direction in which the vehicles must be going if they are to be allowed to pass.

Movement allowed	Binary notation	Code
T	0 0 1	1
L	0 1 0	2
R	1 0 0	4
LT	0 1 1	3
RT	1 0 1	5
RL	1 1 0	6
RLT	1 1 1	7

ie in RLT $\begin{matrix} R \\ L = 1 \text{ if movement allowed} = \emptyset \text{ if no. Code} = \text{value of RLT} \\ T \end{matrix}$ in binary.

Details of the other stages are specified similarly.

NB If a stopline or a particular movement at a stopline at a junction, is not specified in the data, then vehicles will pass, unimpeded by the traffic lights.

Vehicle Activation Routines in ROSIM

VAREAD Reads in V.A. data
 VACT Produces stage changes
 TLREAD Reads in stage change data
 VACHST Changes stage

VAREAD DATA all cards in G5 format

Column Ending Card 1

5	Number of junctions in the network. (Not including Dummy junctions)	
10	Extension produced by the detectors	
Subsequent cards - 3 cards per junction		
- Card A		
5	Junction No	
10	Number of stages at this junction	
15	No of the stage which follows stage 1	
20	"	2
25	"	3
30	"	4
35	Minimum green for stage 1	
40	"	2
45	"	3
50	"	4
55	Maximum green for stage 1	
60	"	2
65	"	3
70	"	4

Column Ending

Card B

5 (10)	1st (2nd) demand detector for stage 1
15 (20, 25, 30, 35, 40)	1st (2nd, 3rd, 4th, 5th, 6th) extension detector for stage 1
45 (50)	1st (2nd) demand detector for stage 2
55 (60, 65, 70, 75, 80)	1st (2nd, 3rd, 4th, 5th, 6th) extension detector for stage 2

Card C

3 (10)	1st (2nd) demand detector for stage 3
15 (20, 25, 30, 35, 40)	1st (2nd, 3rd, 4th, 5th, 6th) extension detector for stage 3
45 (50)	1st (2nd) demand detector for stage 4
55 (60, 65, 70, 75, 80)	1st (2nd, 3rd, 4th, 5th, 6th) extension detector for stage 4

N.B. In the traffic light change stage data, the Dummy junctions should be placed at the end of the data.

SPECIAL VEHICLES DATA (BUSES)

Punched in G10 format

Last digit
in column

10	Number of special vehicles requested.
20	N - start a special vehicle on the Nth ordinary vehicle after start time.

Subsequent cards: 1 card per special vehicle

Last digit
in column

10	Start time of this special vehicle, in seconds.
20	The detector at which the special vehicle starts.
30	Always $\emptyset$
40	Up to 7 prestored turning codes are specified here. Code: 1 = through, 2 = left, 3 = right. The code at the least significant place is used first. e.g. 0000321 At the first stopline the vehicle goes through, at the next left, and at the next right.
50 & 60	Further prestored turning codes. After using the codes in the previous word, the SV then uses the codes in word 50, and finally in 60.
70	Journey type for SV summary.

SUBROUTINE SVREAD

Reads in data for special vehicle priority routines

Punched in I5 format

Last digit
in column

5	Extension produced by S.V. extension detectors.
10	No. of S.V. demand detector. (If $n > 2$, uses the first 'n' extend detector as demand detector)

3 subsequent cards for each junction

Last digit
in column

First card

5	External junction number
10	First stage of this junction
15	Extra green to compensate 1st stage
20	2nd
25	3rd
30	4th
35	Special vehicle maximum green for 1st stage (extra green given after V.A. max green)
40	2nd
45	3rd
50	4th

Second card

5 (10)	1st (second) S.V. demand detector for stage 1
15 (20, 25, 30, 35, 40)	1st (2nd, 3rd, 4th, 5th, 6th) S.V. extension detector for stage 1
45 (50)	S.V. demand detectors for stage 2
55 (60, 65, 70, 75, 80)	S.V. extension detectors for stage 2

Third card

S.V. detectors for stage 3 and 4 - same format as
for previous card.

'DATA' OUTPUT DATA

First Card: Punched in G10 format

Last digit
in column

- | | |
|----|--|
| 10 | The time, in seconds, at which 'DATA' output for the network should start. |
| 20 | The time, in seconds, between successive 'DATA' outputs. |
| 30 | The number of stoplines for which the final 'DATA' output is required. |
| 40 | The increment for delay histogram data (default = 2). |
| 50 | Set to $\emptyset$ if all output is required, a value other than zero will give a printout of stage changes and special vehicle journeys being suppressed. |

Subsequent card(s): Punched in G5 format

A list of stopline numbers (16 per card) for which 'DATA' output is required.

N.B. Stoplines, downstream from Entry points should not be called for 'DATA' output.

A facility, whereby the average number of vehicles queuing in specified parts of the network, over specified incremental periods of time, is output in graphical form, has been incorporated into the simulation. To accommodate this, additional cards (if no graphical output required then 1 blank card) must be submitted after the 'Data' output data (ie. at the end of the present card pack).

Up to 5 graphs may be output

The following cards must be submitted.

Column ending	1st card	-	G10 format
10	Start time (in seconds) at which graphical output is required.		
20	End time (in seconds)		
30	Incremental period (in seconds)		
	(ie. if = 4 say, then every 4 secs the average delay per second over the previous 4 sec period will be output).		
	2nd card	-	G10 format
10 (20,30,40,50)	Specifies the part(s) of the network for which output is required for the 1st (2nd, 3rd, 4th, 5th) graph(s), using the following code		
	0	:	no graph
	9999	:	all links
	Y	:	Y $\neq$ 9999, Y > 0 one specific link Y
			(NB. links are denoted by the stopline no. at the end of the link)
	- X	:	X > 0, a group of X links which are specified on additional cards in the following format.
			The stoplines to be included are punched in G5 format in the first 5X columns of the card(s).

3rd card - G5 format

- 5 (20,35,50,65) The position (1 - 125) across the page of computer output,
at which the graph is to be printed.
- 10(25,40,55,70) The datum of the graph : the no. of vehicles queued
which is repressed by the axis.
- 15(30,45,60,75) Scaling factor : x $\Rightarrow$ that each * output represents
an average over the incremental period of x vehicles
queued per second.

4th card

- 1 blank.
- 2 1 the symbol which is to form the axis.
- 3 * the symbol which is to be output to indicate
vehicles queued.

APPENDIX VI

TRANSYT Output for the AM Peak with Two Bus Links
and a Bus Delay Weighting of 20

CBD WEST NETWORK - 108-121 STREET AM PEAK

TRANSYT/7

CARD NO.	CARD TYPE	CYCLE TIME	STEPS PER CYC.	STOP PENALTY	PERIOD LENGTH	LAG START	LAG END	WEIGHT+ EQUISAT	J.T./S	PRINT	MARKERS CHECK	STEPS OR SECS	SCALE FLOWS	NO.OF COPIES
1	1	86	43	20	60	2	3	1	1	1	0	0	0	0

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE	85	81	87	89	91	46	48	83	93	61	76	65	0
2	2	95												

HILLCLIMB STEP-SIZE LIST

CARD NO.	CARD TYPE	7	17	7	17	1	-1	1	0	0	0	0	0	0
3	4													

CARD NO.	CARD TYPE	UPPER LIMIT	1	2	3	4	5	6	7	8	9	10	11	12	13	14
4	5	4	62	83	96	99	0	0	0	0	0	0	0	0	0	0

LINKS HAVING SHARED STOPLINES

CARD NO.	CARD TYPE	FIRST SET	SECOND SET	THIRD SET
5	7	482	488	0
6	7	892	898	0
7	7	852	858	0

CARD NO.	CARD TYPE	NO.	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
8	12	95	0	20	26	0	0	0	0
9	12	85	0	15	26	0	0	0	0
10	12	81	0	20	28	0	0	0	0
11	12	87	0	20	26	0	0	0	0
12	12	89	0	20	26	0	0	0	0
13	13	91	0	15	26	0	0	0	0
14	14	46	0	16	28	0	0	0	0
15	12	48	0	15	26	0	0	0	0
16	13	83	0	15	26	0	0	0	0
17	12	93	0	17	20	0	0	0	0
18	12	61	0	20	24	0	0	0	0
19	12	76	0	15	23	0	0	0	0
20	12	65	0	15	20	0	0	0	0

CARD NO.	CARD TYPE	EXIT NODE	LINK NO.	STAGE	LAG	STAGE	LAG	STAGE	LAG	LINK LENGTH	STOP PENALTY	SAT FLOW	DELAY WT.X100	DISPSN X100
21	31	95	951	2	5	1	0	0	0	710	1	4294	0	0
22	31	95	952	1	5	2	0	0	0	500	1	3472	500	0
23	31	95	953	2	10	1	0	0	0	500	1	1240	0	0
24	31	95	954	1	5	2	0	0	0	390	1	4340	0	0
25	31	0	958	0	0	0	0	0	0	500	1	0	2000	0
26	31	85	852	1	5	2	0	0	0	390	10	3472	500	0
27	31	85	854	1	5	2	0	0	0	243	1	4340	0	0
28	31	0	858	0	0	0	0	0	0	390	10	0	2000	0

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY A LINK NO.	FLOW	TRAVEL TIME	ENTRY B LINK NO.	FLOW	TRAVEL TIME	ENTRY C LINK NO.	FLOW	TRAVEL TIME	ENTRY D LINK NO.	FLOW	TRAVEL TIME
88	32	951	248	0	0	0	0	838	248	45	0	0	0	0	0	0
89	32	952	1063	0	0	0	0	0	0	0	0	0	0	0	0	0
90	32	953	111	0	0	0	0	0	0	0	0	0	0	0	0	0
91	32	954	537	0	0	0	0	854	537	45	0	0	0	0	0	0
92	32	958	50	0	0	0	0	0	0	0	0	0	0	0	0	0
93	32	852	1421	0	953	111	45	952	1060	45	951	18	45	0	0	0
94	32	854	549	0	811	98	40	814	493	40	813	51	40	0	0	0
95	32	858	36	0	0	0	0	958	36	2644	0	0	0	0	0	0
96	32	859	14	0	0	0	0	958	14	2800	0	0	0	0	0	0
97	32	811	577	0	836	449	40	0	0	0	838	99	40	0	0	0
98	32	812	1608	0	0	0	0	852	1419	35	0	0	0	0	0	0
99	32	813	504	0	0	0	0	0	0	0	0	0	0	0	0	0
100	32	814	567	0	871	28	40	874	574	40	873	10	40	0	0	0
101	32	818	36	0	0	0	0	858	36	2422	0	0	0	0	0	0
102	32	819	14	0	0	0	0	859	14	2800	0	0	0	0	0	0
103	32	871	95	0	0	0	0	0	0	0	0	0	0	0	0	0
104	32	872	1245	0	813	85	35	812	1233	35	811	27	35	0	0	0
105	32	873	46	0	0	0	0	0	0	0	0	0	0	0	0	0
106	32	874	613	0	891	32	40	894	606	40	893	15	40	0	0	0
107	32	878	36	0	0	0	0	818	36	2623	0	0	0	0	0	0
108	32	879	14	0	0	0	0	819	14	2800	0	0	0	0	0	0
109	32	891	173	0	0	0	0	931	80	40	934	73	40	0	0	0
110	32	892	1211	0	873	24	35	872	1221	35	871	33	35	0	0	0
111	32	893	106	0	0	0	0	0	0	0	0	0	0	0	0	0
112	32	894	704	0	0	0	0	914	662	40	913	13	40	0	0	0
113	32	898	36	0	0	0	0	878	36	2422	0	0	0	0	0	0
114	32	899	14	0	0	0	0	879	14	2800	0	0	0	0	0	0
115	32	912	1328	0	893	68	35	892	1164	35	891	51	35	0	0	0
116	32	913	115	0	0	0	0	0	0	0	0	0	0	0	0	0
117	32	914	838	0	461	71	40	464	619	40	467	131	40	0	0	0
118	32	918	50	0	0	0	0	898	36	2800	0	0	0	0	0	0
119	32	461	447	0	0	0	0	761	368	40	764	65	40	0	0	0
120	32	462	925	0	913	59	35	912	960	35	0	0	0	0	0	0
121	32	463	439	0	0	0	0	0	0	0	0	0	0	0	0	0
122	32	464	757	0	481	40	40	484	663	40	483	40	40	0	0	0
123	32	465	224	0	0	0	0	761	224	40	0	0	0	0	0	0
124	32	466	249	0	0	0	0	912	249	35	0	0	0	0	0	0
125	32	467	131	0	0	0	0	0	0	0	0	0	0	0	0	0
126	32	468	36	0	0	0	0	918	36	2622	0	0	0	0	0	0
127	32	469	10	0	0	0	0	918	10	2800	0	0	0	0	0	0
128	32	481	142	0	652	14	40	651	127	40	654	24	40	0	0	0
129	32	482	944	0	0	0	0	462	772	35	465	89	35	0	0	0
130	32	483	132	0	0	0	0	0	0	0	0	0	0	0	0	0
131	32	484	735	0	0	0	0	0	0	0	0	0	0	0	0	0
132	32	488	40	0	0	0	0	468	36	2800	0	0	0	0	0	0
133	32	831	11	0	0	0	0	0	0	0	0	0	0	0	0	0
134	32	832	440	0	0	0	0	0	0	0	0	0	0	0	0	0
135	32	833	451	0	0	0	0	813	137	40	812	237	40	0	0	0
136	32	834	168	0	931	18	40	934	116	40	933	12	40	0	0	0
137	32	836	303	0	0	0	0	0	0	0	0	0	0	0	0	0
138	32	837	268	0	814	12	40	813	231	40	812	100	40	0	0	0
139	32	838	347	0	931	18	40	934	219	40	0	0	0	0	0	0
140	32	931	122	0	0	0	0	0	0	0	0	0	0	0	0	0
141	32	932	671	0	833	443	35	832	429	35	0	0	0	0	0	0
142	32	933	72	0	894	34	40	893	23	40	892	38	40	0	0	0
143	32	934	412	0	0	0	0	614	500	40	613	32	40	0	0	0

144	32	612	726	933	27	35	932	578	35	931	10	35	0
145	32	613	175	914	69	40	913	43	40	912	101	40	0
146	32	614	512	761	60	40	764	302	40	763	15	40	0
147	32	761	806	0	0	0	0	0	0	0	0	0	0
148	32	762	574	613	37	35	612	582	35	0	0	0	0
149	32	763	549	464	81	40	463	439	40	462	153	40	0
150	32	764	415	651	58	40	654	284	40	653	52	40	0
151	32	651	207	0	0	0	0	0	0	0	0	0	0
152	32	652	647	763	36	35	762	528	35	761	83	35	0
153	32	653	197	484	35	40	483	77	40	482	76	40	0
154	32	654	336	0	0	0	0	0	0	0	0	0	0
GRAPH PLOT CARDS													
CARD NO.	CARD TYPE	LINK NO.	LINK NO.	LINK NO.	LINK NO.	LINK NO.	LINK NO.	LINK NO.	LINK NO.	LINK NO.	LINK NO.	LINK NO.	LINK NO.
155	35	952	0	954	812	854	872	814	0	0	0	0	0
156	35	892	874	894	462	914	466	0	0	0	0	0	0
157	35	482	464	484	0	0	0	0	0	0	0	0	0
158	35	836	0	0	932	834	0	838	0	0	0	0	0
159	35	612	934	614	652	764	0	654	0	0	0	0	0
160	35	953	0	951	813	0	837	811	0	0	0	0	0
161	35	833	0	831	873	0	0	871	0	0	0	0	0
162	35	893	0	891	0	931	0	0	0	0	0	0	0
163	35	913	0	0	463	0	467	0	0	0	0	0	0
164	35	763	461	465	0	761	0	0	0	0	0	0	0
165	35	483	0	481	0	651	0	0	0	0	0	0	0
166	35	958	0	859	818	819	878	879	0	0	0	0	0
167	35	898	899	0	468	469	488	0	0	0	0	0	0

INITIAL SETTINGS

LINK NUMBER	NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
461	46	4	0	16	30	33				447	1550	83	104.60	8.283	4.711	0.958	0.12 (99%)	11	46	37	66
462	48	2	0	30						925	3410S	50	225.70	11.856	5.284	0.124	0.21 (83%)	19	46	71	32
463	61	2	0	31						439	3100	51	103.16	3.203	3.073	0.130	0.10 (80%)	9	46	37	60
464	65	2	0	29						757	4340	50	92.35	6.129	3.695	0.125	0.11 (52%)	9	46	3	32
465	76	2	0	27						224	2790	23	52.42	3.384	2.056	0.017	0.06 (99%)	5	46	37	66
466	81	2	0	27						249	1550S	80	60.76	4.359	1.890	0.734	0.07 (98%)	6	46	71	2
467	83	3	0	13	32					131	1240	18	30.78	0.300	0.290	0.010	0.02 (43%)	1	46	37	0
468*	85	2	0	30						36	462L	50	8.78	0.764	0.125	0.005	0.01 (72%)	19	46	71	32
469*	87	2	0	30						10	466L	80	2.44	0.186	0.069	0.029	0.00 (99%)	6	46	71	2
481	89	2	0	29						142	2015	28	33.65	2.211	1.344	0.026	0.03 (73%)	2	48	65	0
482	91	3	0	24	37					944	4030S	37	115.17	4.183	0.839	0.054	0.14 (54%)	15	48	5	60
483	93	2	0	33						132	2015	26	31.02	0.927	0.905	0.022	0.03 (75%)	2	48	65	0
484	95	2	0	30						735	4154	27	89.67	1.237	1.211	0.025	0.08 (38%)	7	48	5	60
488*										40	482L	37	4.88	0.195	0.019	0.002	0.00 (40%)	15	48	5	60
612										726	1395	77	88.57	4.042	0.866	0.646	0.05 (23%)	4	61	67	0
613										175	2015	37	41.13	2.192	1.109	0.056	0.04 (81%)	3	61	5	62
614										512	2759	28	124.93	3.047	0.508	0.026	0.04 (25%)	3	61	63	0
651										207	2015	37	103.50	1.437	1.383	0.054	0.04 (75%)	4	65	65	58
652										647	2682	38	78.93	3.438	1.123	0.060	0.06 (31%)	5	65	5	58
653										197	2015	35	46.69	2.802	1.587	0.047	0.04 (80%)	4	65	63	0
654										336	2666	20	40.99	0.608	0.595	0.012	0.04 (38%)	3	65	5	58
761										806	3519	70	143.47	5.896	5.480	0.415	0.18 (82%)	16	76	59	0
762										574	1395	71	70.03	3.981	1.555	0.426	0.06 (37%)	6	76	5	54
763										549	3255	52	128.47	5.715	2.365	0.139	0.11 (74%)	11	76	59	0
764										415	2046	35	50.63	2.212	0.899	0.047	0.05 (39%)	4	76	5	54
811										577	2387	74	134.44	11.535	7.644	0.530	0.15 (96%)	13	81	59	0
812										1608	3875S	74	390.74	18.297	6.637	0.496	0.25 (56%)	22	81	5	54
813										504	2170	71	252.00	3.883	3.442	0.440	0.12 (83%)	10	81	59	0
814										567	3875	25	138.35	4.739	1.259	0.021	0.06 (38%)	5	81	5	54
818*										36	812L	74	8.75	0.851	0.186	0.011	0.01 (80%)	22	81	5	54
819*										14	812L	74	3.40	0.160	0.034	0.004	0.00 (38%)	22	81	5	54
831										11	1240	2	5.50	0.046	0.046	0.000	0.00 (57%)	0	83	31	64
832										440	1550	55	220.00	1.840	1.667	0.172	0.08 (63%)	7	83	69	26
833										451	1395	82	105.08	6.201	2.680	0.894	0.11 (85%)	9	83	31	64
834										168	1550	39	82.32	3.226	1.106	0.062	0.04 (76%)	3	83	3	26

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)	RUN ON FEB 19.
836	303	1550	84	151.50	3.623	2.569	1.054	0.08 (91%)	7	83	69	2	
837	268	1395	30	62.44	2.368	0.777	0.031	0.04 (52%)	3	83	31	0	
838	347	2790	45	170.03	6.447	2.107	0.089	0.07 (77%)	6	83	3	26	
852	1421	3472S	65	554.19	15.551	2.944	0.292	0.17 (42%)	15	85	5	60	
854	549	4340	19	133.41	4.140	0.793	0.012	0.05 (33%)	4	85	5	60	
858*	36	852L	65	14.04	1.140	0.076	0.007	0.01 (51%)	15	85	5	60	
859*	14	852L	65	5.46	0.240	0.042	0.003	0.00 (60%)	15	85	5	60	
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	65	0	
872	1245	3348S	59	303.78	11.685	2.797	0.209	0.13 (39%)	13	87	5	60	
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	65	0	
874	613	3379	28	149.57	5.159	1.392	0.027	0.07 (44%)	7	87	5	60	
878*	36	872L	59	8.78	0.784	0.133	0.006	0.01 (69%)	13	87	5	60	
879*	14	872L	59	3.42	0.177	0.053	0.002	0.00 (60%)	13	87	5	60	
891	173	1085	57	40.65	2.990	1.785	0.189	0.04 (89%)	4	89	63	0	
892	1211	3364S	60	295.48	12.529	3.875	0.212	0.18 (53%)	16	89	5	58	
893	106	1085	35	53.00	0.752	0.705	0.047	0.02 (75%)	2	89	63	0	
894	704	2945	38	85.89	2.667	0.461	0.058	0.04 (22%)	5	89	5	58	
898*	36	892L	60	8.78	0.800	0.138	0.006	0.01 (66%)	16	89	5	58	
899*	14	892L	60	3.42	0.157	0.032	0.002	0.00 (40%)	16	89	5	58	
912	1328	3255S	79	162.02	9.565	4.217	0.719	0.15 (40%)	15	91	3	48	
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	53	74	
914	838	3100	42	204.47	6.613	1.428	0.073	0.08 (33%)	7	91	79	48	
918*	50	912L	79	6.10	0.382	0.137	0.027	0.00 (31%)	15	91	3	48	
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	71	0	
932	671	1395	67	328.79	10.729	1.002	0.333	0.09 (47%)	8	93	5	66	
933	72	1085	36	16.92	1.011	0.539	0.049	0.02 (79%)	1	93	71	0	
934	412	3643	16	50.26	1.487	0.224	0.007	0.01 (13%)	1	93	5	66	
951	248	4294	23	176.08	4.899	0.969	0.016	0.04 (62%)	4	95	65	0	
952	1063	3472S	49	531.50	2.237	2.123	0.114	0.14 (46%)	13	95	5	60	
953	111	1240	45	55.50	1.005	0.912	0.093	0.03 (85%)	2	95	70	0	
954	537	4340	19	209.43	5.604	0.939	0.011	0.06 (38%)	5	95	5	60	
958	50	952L	49	25.00	0.105	0.100	0.005	0.01 (46%)	13	95	5	60	

TIME SINCE START OF RUN	USE OF		TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
	SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS							

aaaa	1	83	7212.18	251.315	103.758	10.811	5.67	437.82	28.70
			78.25	5.837	1.044	0.106	0.12	25.40	13.41 BUSES
			7133.92	245.478	102.714	10.704	5.55	412.42	29.06 OTHER

CPU TIME USED SO FAR IS 1.15 SECS

CBD WEST NETWORK - 108-121 STREET AM PEAK

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7

LINK NUMBER	NODE NO	STAGE							UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN PERIOD	
		NUMBER OF STAGES	1	2	3	4	5	6	7			START (SEC)	END (SEC)
461	46	4	21	37	8	11			0.09 (70%)	9	46	79	22
462	48	2	14	1					0.11 (44%)	11	46	27	74
463	61	2	36	24					0.10 (80%)	9	46	79	16
464	65	2	7	36					0.15 (73%)	14	46	45	74
465	76	2	0	27					0.01 (12%)	1	46	79	22
466	81	2	7	34					0.06 (80%)	5	46	27	44
467	83	3	36	6	25				0.02 (43%)	1	46	79	42
468*	85	2	36	23					0.00 (36%)	11	46	27	74
469*	87	2	21	8					0.00 (79%)	5	46	27	44
481	89	2	36	22					0.02 (40%)	1	48	7	28
482	91	3	36	17	30				0.03 (10%)	2	48	33	2
483	93	2	36	26					0.03 (75%)	2	48	7	28
484	95	2	36	23					0.08 (38%)	7	48	33	2
488*									0.00 (2%)	2	48	33	2
612									0.05 (23%)	4	61	77	48
613									0.04 (82%)	4	61	53	72
614									0.05 (36%)	5	61	77	48
651									0.04 (75%)	4	65	77	14
652									0.05 (26%)	5	65	19	72
653									0.04 (82%)	4	65	77	14
654									0.04 (38%)	3	65	19	72
761									0.18 (82%)	16	76	59	0
762									0.06 (35%)	5	76	5	54
763									0.13 (86%)	11	76	59	0
764									0.05 (44%)	5	76	5	54
811									0.04 (27%)	5	81	73	14
812									0.20 (45%)	19	81	19	68
813									0.12 (83%)	10	81	73	14
814									0.11 (67%)	9	81	19	68
818*									0.00 (46%)	19	81	19	68
819*									0.00 (65%)	19	81	19	68
831									0.00 (57%)	0	83	17	50
832									0.08 (63%)	7	83	55	12
833									0.10 (81%)	9	83	17	50
834									0.04 (78%)	3	83	75	12

GBD WEST NETWORK - 108-121 STREET AM PEAK

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17

LINK NUMBER	NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
461	46	4	21	37	8	11				0.09 (70%)	9	46	79	22
462	48	2	14	1						0.11 (44%)	11	46	27	74
463	61	2	36	24						0.10 (80%)	9	46	79	16
464	65	2	7	36						0.15 (73%)	14	46	45	74
465	76	2	0	27						0.01 (12%)	1	46	79	22
466	81	2	7	34						0.06 (80%)	5	46	27	44
467	83	3	36	6	25					0.02 (43%)	1	46	79	42
468*	85	2	36	23						0.00 (36%)	11	46	27	74
469*	87	2	21	8						0.00 (79%)	5	46	27	44
481	89	2	36	22						0.02 (40%)	1	48	7	28
482	91	3	36	17	30					0.03 (10%)	2	48	33	2
483	93	2	36	26						0.03 (75%)	2	48	7	28
484	95	2	36	23						0.08 (38%)	7	48	33	2
488*										0.00 (2%)	2	48	33	2
612										0.05 (23%)	4	61	77	48
613										0.04 (82%)	4	61	53	72
614										0.05 (36%)	5	61	77	48
651										0.04 (75%)	4	65	77	14
652										0.05 (26%)	5	65	19	72
653										0.04 (82%)	4	65	77	14
654										0.04 (38%)	3	65	19	72
761										0.18 (82%)	16	76	59	0
762										0.06 (35%)	5	76	5	54
763										0.13 (86%)	11	76	59	0
764										0.05 (44%)	5	76	5	54
811										0.04 (27%)	5	81	73	14
812										0.20 (45%)	19	81	19	68
813										0.12 (83%)	10	81	73	14
814										0.11 (67%)	9	81	19	68
818*										0.00 (46%)	19	81	19	68
819*										0.00 (65%)	19	81	19	68
831										0.00 (57%)	0	83	17	50
832										0.08 (63%)	7	83	55	12
833										0.10 (81%)	9	83	17	50
834										0.04 (78%)	3	83	75	12

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	84	151.50	3.623	2.569	1.054	0.08 (91%)	7	83	55	74
837	268	1395	30	62.44	1.964	0.372	0.031	0.04 (51%)	4	83	17	72
838	347	2790	45	170.03	6.594	2.254	0.089	0.08 (79%)	7	83	75	12
852	1421	3472S	65	554.19	15.551	2.943	0.292	0.17 (42%)	15	85	77	46
854	549	4340	19	133.41	4.524	1.177	0.012	0.06 (39%)	5	85	77	46
858*	36	852L	65	14.04	1.140	0.075	0.007	0.01 (51%)	15	85	77	46
859*	14	852L	65	5.46	0.240	0.042	0.003	0.00 (60%)	15	85	77	46
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	21	42
872	1245	3348S	59	303.78	9.969	1.081	0.209	0.11 (32%)	12	87	47	16
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	21	42
874	613	3379	28	149.57	5.725	1.959	0.027	0.11 (63%)	9	87	47	16
878*	36	872L	59	8.78	0.716	0.065	0.006	0.00 (38%)	12	87	47	16
879*	14	872L	59	3.42	0.130	0.006	0.002	0.00 (25%)	12	87	47	16
891	173	1085	57	40.65	3.048	1.843	0.189	0.04 (90%)	4	89	49	72
892	1211	3364S	60	295.48	9.910	1.256	0.212	0.14 (40%)	14	89	77	44
893	106	1085	35	53.00	0.752	0.705	0.047	0.02 (75%)	2	89	49	72
894	704	2945	38	85.89	2.466	0.260	0.058	0.03 (16%)	4	89	77	44
898*	36	892L	60	8.78	0.734	0.072	0.006	0.00 (42%)	14	89	77	44
899*	14	892L	60	3.42	0.131	0.007	0.002	0.00 (32%)	14	89	77	44
912	1328	3255S	79	162.02	8.939	3.591	0.719	0.13 (34%)	12	91	75	34
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	39	60
914	838	3100	42	204.47	5.617	0.432	0.073	0.03 (14%)	4	91	65	34
918*	50	912L	79	6.10	0.373	0.128	0.027	0.00 (29%)	12	91	75	34
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	57	72
932	671	1395	67	328.79	10.720	0.993	0.333	0.09 (46%)	8	93	77	52
933	72	1085	36	16.92	1.055	0.582	0.049	0.02 (84%)	1	93	57	72
934	412	3643	16	50.26	1.523	0.259	0.007	0.02 (15%)	1	93	77	52
951	248	4294	23	176.08	4.897	0.967	0.016	0.04 (62%)	4	95	51	72
952	1063	3472S	49	531.50	2.237	2.123	0.114	0.14 (46%)	13	95	77	46
953	111	1240	45	55.50	1.005	0.912	0.093	0.03 (85%)	2	95	56	72
954	537	4340	19	209.43	5.429	0.764	0.011	0.06 (37%)	5	95	77	46
958	50	952L	49	25.00	0.105	0.100	0.005	0.01 (46%)	13	95	77	46

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
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aaaa	27	1077	7212.18	227.500	79.943	10.811	5.17	318.04	31.70
			78.25	5.474	0.680	0.106	0.10	17.76	14.30 BUSES
			7133.92	222.027	79.263	10.704	5.07	300.28	32.13 OTHER

CPU TIME USED SO FAR IS 6.26 SECS

GBD WEST NETWORK - 108-121 STREET AM PEAK

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17 -1

LINK NUMBER	NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	GREEN PERIOD END (SEC)
461	46	4	21	37	8	11				1.168	0.958	0.08 (65%)	9	46	79	22
462	48	2	14	1						1.277	0.124	0.12 (48%)	13	46	27	74
463	61	2	36	24						3.073	0.130	0.10 (80%)	9	46	79	16
464	65	2	3	36						3.516	0.125	0.15 (73%)	14	46	45	74
465	76	2	41	27						0.208	0.017	0.01 (10%)	1	46	79	22
466	81	2	5	34						1.674	0.734	0.06 (80%)	5	46	27	44
467	83	3	36	7	24					0.290	0.010	0.02 (43%)	1	46	79	42
468*	85	2	36	23						0.074	0.005	0.00 (36%)	13	46	27	74
469*	87	2	21	8						0.069	0.029	0.00 (79%)	5	46	27	44
481	89	2	35	22						0.612	0.026	0.01 (36%)	1	48	7	28
482	91	3	36	17	30					0.470	0.054	0.03 (10%)	2	48	33	2
483	93	2	36	26						0.905	0.022	0.03 (75%)	2	48	7	28
484	95	2	36	23						1.211	0.025	0.08 (38%)	7	48	33	2
488*										0.006	0.002	0.00 (2%)	2	48	33	2
612										0.824	0.646	0.04 (22%)	4	61	77	48
613										1.235	0.056	0.04 (82%)	4	61	53	72
614										0.639	0.026	0.04 (28%)	4	61	77	48
651										1.773	0.169	0.05 (87%)	4	65	77	6
652										0.467	0.042	0.03 (18%)	3	65	11	72
653										1.659	0.145	0.05 (89%)	4	65	77	6
654										0.326	0.009	0.03 (28%)	2	65	11	72
761										6.281	0.925	0.20 (89%)	17	76	59	82
762										0.657	0.310	0.04 (22%)	4	76	1	54
763										4.847	0.230	0.14 (89%)	12	76	59	82
764										0.574	0.039	0.04 (35%)	4	76	1	54
811										2.233	1.348	0.10 (64%)	11	81	73	10
812										1.633	0.353	0.13 (29%)	15	81	15	68
813										3.944	1.004	0.12 (89%)	11	81	73	10
814										2.260	0.018	0.10 (64%)	9	81	15	68
818*										0.077	0.008	0.00 (42%)	15	81	15	68
819*										0.023	0.003	0.00 (36%)	15	81	15	68
831										0.054	0.000	0.00 (61%)	0	83	19	48
832										1.357	0.131	0.07 (56%)	6	83	53	14
833										2.942	2.512	0.11 (88%)	10	83	19	48
834										1.070	0.050	0.03 (74%)	3	83	75	14

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	76	151.50	3.019	2.413	0.606	0.07 (88%)	7	83	53	74
837	268	1395	31	62.44	2.060	0.465	0.034	0.04 (59%)	4	83	19	72
838	347	2790	41	170.03	6.421	2.099	0.072	0.07 (76%)	6	83	75	14
852	1421	3472S	65	554.19	15.551	2.943	0.292	0.17 (42%)	15	85	77	46
854	549	4340	19	133.41	4.243	0.896	0.012	0.05 (31%)	4	85	77	46
858*	36	852L	65	14.04	1.140	0.075	0.007	0.01 (51%)	15	85	77	46
859*	14	852L	65	5.46	0.240	0.042	0.003	0.00 (60%)	15	85	77	46
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	21	42
872	1245	3348S	59	303.78	10.425	1.537	0.209	0.15 (43%)	15	87	47	16
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	21	42
874	613	3379	28	149.57	5.641	1.875	0.027	0.10 (61%)	9	87	47	16
878*	36	872L	59	8.78	0.717	0.066	0.006	0.00 (40%)	15	87	47	16
879*	14	872L	59	3.42	0.137	0.013	0.002	0.00 (50%)	15	87	47	16
891	173	1085	62	40.65	3.171	1.900	0.255	0.04 (91%)	4	89	49	70
892	1211	3364S	58	295.48	9.586	0.956	0.187	0.11 (32%)	13	89	75	44
893	106	1085	38	53.00	0.811	0.752	0.059	0.02 (78%)	2	89	49	70
894	704	2945	37	85.89	2.378	0.178	0.053	0.01 (7%)	1	89	75	44
898*	36	892L	58	8.78	0.723	0.061	0.006	0.00 (38%)	13	89	75	44
899*	14	892L	58	3.42	0.128	0.004	0.002	0.00 (18%)	13	89	75	44
912	1328	3255S	79	162.02	8.844	3.496	0.719	0.13 (35%)	13	91	75	34
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	39	60
914	838	3100	42	204.47	5.618	0.432	0.073	0.03 (14%)	4	91	65	34
918*	50	912L	79	6.10	0.376	0.131	0.027	0.00 (30%)	13	91	75	34
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	57	72
932	671	1395	67	328.79	10.640	0.913	0.333	0.09 (46%)	8	93	77	52
933	72	1085	36	16.92	1.065	0.593	0.049	0.02 (84%)	1	93	57	72
934	412	3643	16	50.26	1.557	0.293	0.007	0.02 (16%)	2	93	77	52
951	248	4294	23	176.08	4.913	0.984	0.016	0.04 (62%)	4	95	51	72
952	1063	3472S	49	531.50	2.237	2.123	0.114	0.14 (46%)	13	95	77	46
953	111	1240	45	55.50	1.005	0.912	0.093	0.03 (85%)	2	95	56	72
954	537	4340	19	209.43	5.578	0.913	0.011	0.06 (43%)	6	95	77	46
958	50	952L	49	25.00	0.105	0.100	0.005	0.01 (46%)	13	95	77	46

TIME SINCE START OF RUN	USE OF		TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
	SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS							
aaaa	35	973	7212.18	230.005	79.398	13.860	5.12	309.77	31.36
			78.25	5.429	0.641	0.101	0.10	16.85	14.41 BUSES
			7133.92	224.576	78.757	13.759	5.02	292.92	31.77 OTHER

CPU TIME USED SO FAR IS 8.22 SECS

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17 -1 7

LINK NUMBER	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
46	4	21	37	8	11				447	1550	83	104.60	4.740	1.167	0.958	0.08 (65%)	9	46	79	22
48	2	14	1						925	3410S	50	225.70	7.918	1.346	0.124	0.14 (53%)	13	46	27	74
61	2	36	24						439	3100	51	103.16	3.203	3.073	0.130	0.10 (80%)	9	46	79	16
65	2	3	36						757	4340	50	92.35	5.950	3.516	0.125	0.15 (73%)	14	46	45	74
76	2	41	27						224	2790	23	52.42	1.536	0.208	0.017	0.01 (10%)	1	46	79	22
81	2	5	34						249	1550S	80	60.76	4.041	1.571	0.734	0.06 (81%)	5	46	27	44
83	3	36	7	24					131	1240	18	30.78	0.300	0.290	0.010	0.02 (43%)	1	46	79	42
85	2	36	23						36	462L	50	8.78	0.711	0.071	0.005	0.00 (35%)	13	46	27	74
87	2	14	1						10	466L	80	2.44	0.178	0.061	0.029	0.00 (75%)	5	46	27	44
89	2	28	15						142	2015	28	33.65	1.479	0.612	0.026	0.01 (36%)	1	48	7	28
91	3	36	17	30					944	4030S	37	115.17	3.809	0.465	0.054	0.03 (10%)	2	48	33	2
93	2	36	26						132	2015	26	31.02	0.927	0.905	0.022	0.03 (75%)	2	48	7	28
95	2	29	16						735	4154	27	89.67	1.237	1.211	0.025	0.08 (38%)	7	48	33	2
									40	482L	37	4.88	0.183	0.006	0.002	0.00 (2%)	2	48	33	2
461									726	1395	77	88.57	4.004	0.827	0.646	0.04 (22%)	4	61	77	48
462									175	2015	37	41.13	2.336	1.252	0.056	0.04 (83%)	4	61	53	72
463									512	2759	28	124.93	3.178	0.639	0.026	0.04 (28%)	3	61	77	48
464									207	2015	55	103.50	1.943	1.773	0.169	0.05 (87%)	4	65	77	6
465									647	2682	33	78.93	2.764	0.467	0.042	0.03 (18%)	3	65	11	72
466									197	2015	53	46.69	2.961	1.649	0.145	0.05 (89%)	4	65	77	6
467									336	2666	17	40.99	0.335	0.326	0.009	0.03 (28%)	2	65	11	72
468*									806	3519	82	143.47	7.206	6.281	0.925	0.20 (89%)	17	59	59	82
469*									574	1395	66	70.03	2.968	0.657	0.310	0.04 (22%)	4	76	1	54
481									549	3255	60	128.47	8.281	4.839	0.230	0.14 (89%)	12	59	59	82
482									415	2046	32	50.63	1.878	0.574	0.039	0.04 (35%)	4	76	1	54
483									577	2387	87	134.44	6.941	2.233	1.348	0.10 (64%)	11	73	73	10
484									1608	3875S	68	390.74	12.821	1.305	0.353	0.10 (21%)	12	15	15	68
488*									504	2170	83	252.00	4.948	3.944	1.004	0.12 (89%)	11	73	73	10
612									567	3875	23	138.35	4.562	1.086	0.018	0.05 (33%)	5	81	15	68
613									36	812L	68	8.75	0.729	0.066	0.008	0.00 (36%)	12	81	15	68
614									14	812L	68	3.40	0.141	0.016	0.003	0.00 (22%)	12	81	15	68
651									11	1240	3	5.50	0.054	0.054	0.000	0.00 (61%)	0	83	19	48
652									440	1550	51	220.00	1.488	1.357	0.131	0.07 (56%)	6	83	53	14
653									451	1395	93	105.08	8.248	3.109	2.512	0.11 (90%)	10	83	19	48
654									168	1550	36	82.32	3.177	1.069	0.050	0.03 (74%)	3	75	75	14

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	76	151.50	3.019	2.413	0.606	0.07 (88%)	7	83	53	74
837	268	1395	31	62.44	2.067	0.472	0.034	0.04 (59%)	4	83	19	72
838	347	2790	41	170.03	6.421	2.099	0.072	0.07 (76%)	6	83	75	14
852	1421	3472S	65	554.19	14.808	2.200	0.292	0.12 (30%)	11	85	77	46
854	549	4340	19	133.41	3.824	0.477	0.012	0.03 (19%)	3	85	77	46
858*	36	852L	65	14.04	1.151	0.086	0.007	0.01 (52%)	11	85	77	46
859*	14	852L	65	5.46	0.227	0.029	0.003	0.00 (41%)	11	85	77	46
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	7	28
872	1245	3348S	59	303.78	10.207	1.319	0.209	0.07 (21%)	7	87	33	2
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	7	28
874	613	3379	28	149.57	5.266	1.500	0.027	0.11 (62%)	9	87	33	2
878*	36	872L	59	8.78	0.731	0.080	0.006	0.00 (47%)	7	87	33	2
879*	14	872L	59	3.42	0.145	0.021	0.002	0.00 (22%)	7	87	33	2
891	173	1085	62	40.65	2.886	1.615	0.255	0.04 (92%)	4	89	35	56
892	1211	3364S	58	295.48	9.661	1.031	0.187	0.09 (28%)	10	89	61	30
893	106	1085	38	53.00	0.811	0.752	0.059	0.02 (78%)	2	89	35	56
894	704	2945	37	85.89	2.751	0.551	0.053	0.03 (13%)	2	89	61	30
898*	36	892L	58	8.78	0.720	0.058	0.006	0.00 (35%)	10	89	61	30
899*	14	892L	58	3.42	0.133	0.009	0.002	0.00 (22%)	10	89	61	30
912	1328	3255S	79	162.02	8.733	3.385	0.719	0.24 (64%)	23	91	75	34
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	39	60
914	838	3100	42	204.47	5.618	0.432	0.073	0.03 (14%)	4	91	65	34
918*	50	912L	79	6.10	0.360	0.115	0.027	0.01 (62%)	23	91	75	34
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	57	72
932	671	1395	67	328.79	10.641	0.914	0.333	0.09 (46%)	8	93	77	52
933	72	1085	36	16.92	1.078	0.605	0.049	0.02 (88%)	2	93	57	72
934	412	3643	16	50.26	1.557	0.293	0.007	0.02 (16%)	2	93	77	52
951	248	4294	23	176.08	5.323	1.394	0.016	0.03 (47%)	3	95	37	58
952	1063	3472S	49	531.50	2.237	2.123	0.114	0.14 (46%)	13	95	63	32
953	111	1240	45	55.50	1.005	0.912	0.093	0.03 (85%)	2	95	42	58
954	537	4340	19	209.43	5.660	0.995	0.011	0.06 (41%)	5	95	63	32
958	50	952L	49	25.00	0.105	0.100	0.005	0.01 (46%)	13	95	63	32

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
>aaaa	30	1097	7212.18	227.419	76.812	13.860	4.60	291.40	31.71
			78.25	5.406	0.619	0.101	0.10	16.33	14.47 BUSES
			7133.92	222.013	76.193	13.759	4.50	275.07	32.13 OTHER

CPU TIME USED 50 FAR IS 10.36 SECS

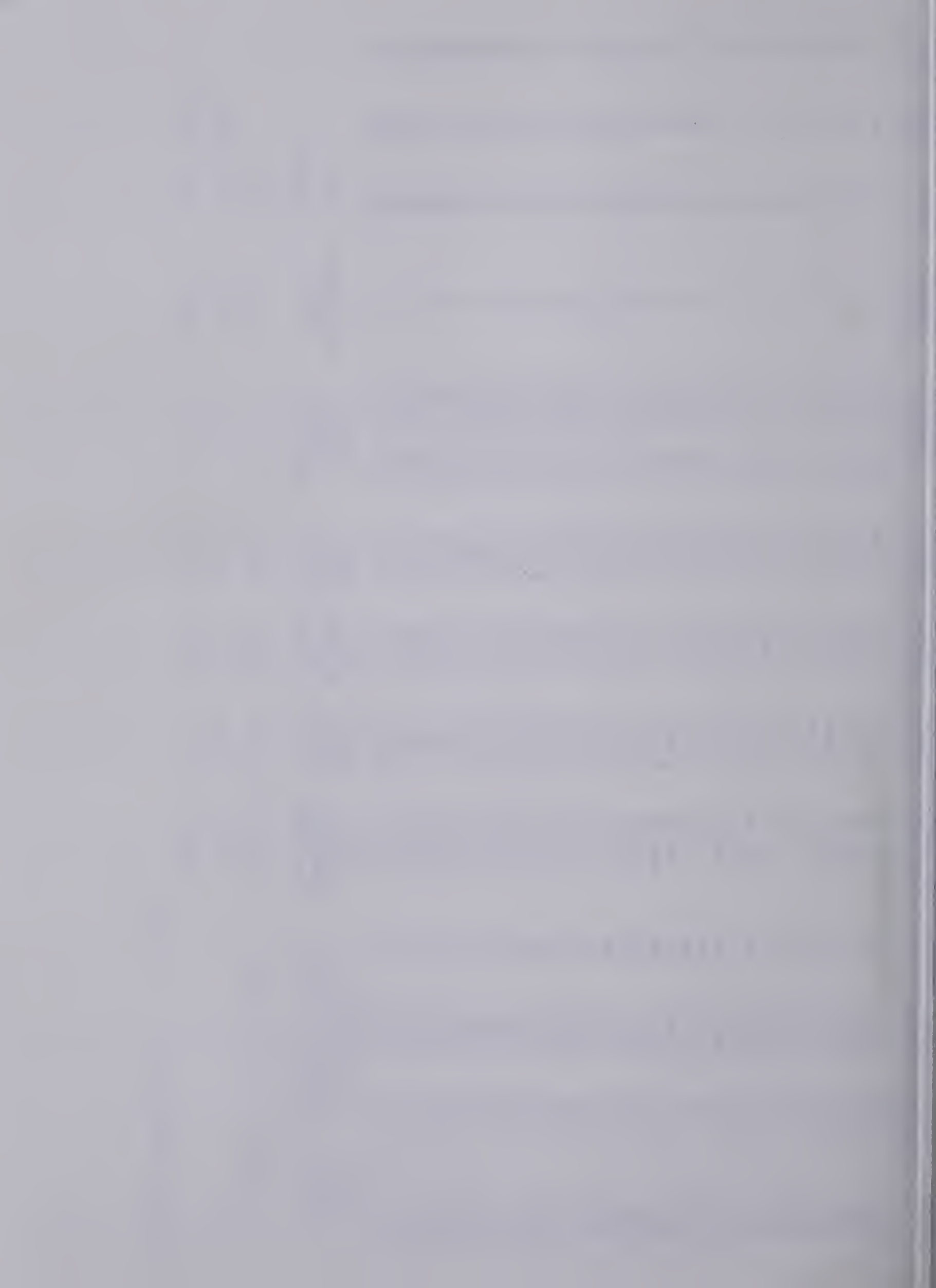
INTERMEDIATE SETTINGS - STEP SIZES SO FAR :-

LINK NUMBER	NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
461	46	4	21	37	8	11				1.167	0.958	0.08 (65%)	9	46	79	22
462	48	2	14	1						1.346	0.124	0.14 (53%)	13	46	27	74
463	61	2	36	24						3.073	0.130	0.10 (80%)	9	46	79	16
464	65	2	3	36						3.516	0.125	0.15 (73%)	14	46	45	74
465	76	2	41	27						0.208	0.017	0.01 (10%)	1	46	79	22
466	81	2	5	34						1.571	0.734	0.06 (81%)	5	46	27	44
467	83	3	36	7	24					0.290	0.010	0.02 (43%)	1	46	79	42
468*	85	2	36	23						0.071	0.005	0.00 (35%)	13	46	27	74
469*	87	2	14	1						0.061	0.029	0.00 (75%)	5	46	27	44
481	89	2	28	15						0.612	0.026	0.01 (36%)	1	48	7	28
482	91	3	36	17	30					0.465	0.054	0.03 (10%)	2	48	33	2
483	93	2	36	26						0.905	0.022	0.03 (75%)	2	48	7	28
484	95	2	29	16						1.211	0.025	0.08 (38%)	7	48	33	2
488*										0.006	0.002	0.00 (2%)	2	48	33	2
612										0.827	0.646	0.04 (22%)	4	61	77	48
613										1.252	0.056	0.04 (83%)	4	61	53	72
614										0.639	0.026	0.04 (28%)	3	61	77	48
651										1.773	0.169	0.05 (87%)	4	65	77	6
652										0.467	0.042	0.03 (18%)	3	65	11	72
653										1.649	0.145	0.05 (89%)	4	65	77	6
654										0.326	0.009	0.03 (28%)	2	65	11	72
761										6.281	0.925	0.20 (89%)	17	76	59	82
762										0.657	0.310	0.04 (22%)	4	76	1	54
763										4.839	0.230	0.14 (89%)	12	76	59	82
764										0.574	0.039	0.04 (35%)	4	76	1	54
811										2.233	1.348	0.10 (64%)	11	81	73	10
812										1.305	0.353	0.10 (21%)	12	81	15	68
813										3.944	1.004	0.12 (89%)	11	81	73	10
814										1.086	0.018	0.05 (33%)	5	81	15	68
818*										0.066	0.008	0.00 (36%)	12	81	15	68
819*										0.016	0.003	0.00 (22%)	12	81	15	68
831										0.054	0.000	0.00 (61%)	0	83	19	48
832										1.357	0.131	0.07 (56%)	6	83	53	14
833										3.109	2.512	0.11 (90%)	10	83	19	48
834										1.069	0.050	0.03 (74%)	3	83	75	14

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN PERIOD START (SEC)	PERIOD END (SEC)
836	303	1550	76	151.50	3.019	2.413	0.606	0.07 (88%)	7	83	53	74
837	268	1395	31	62.44	2.067	0.472	0.034	0.04 (59%)	4	83	19	72
838	347	2790	41	170.03	6.421	2.099	0.072	0.07 (76%)	6	83	75	14
852	1421	3472S	65	554.19	14.808	2.200	0.292	0.12 (30%)	11	85	77	46
854	549	4340	19	133.41	3.824	0.477	0.012	0.03 (19%)	3	85	77	46
858*	36	852L	65	14.04	1.151	0.086	0.007	0.01 (52%)	11	85	77	46
859*	14	852L	65	5.46	0.227	0.029	0.003	0.00 (41%)	11	85	77	46
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	7	28
872	1245	3348S	59	303.78	10.207	1.319	0.209	0.07 (21%)	7	87	33	2
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	7	28
874	613	3379	28	149.57	5.266	1.500	0.027	0.11 (62%)	9	87	33	2
878*	36	872L	59	8.78	0.731	0.080	0.006	0.00 (47%)	7	87	33	2
879*	14	872L	59	3.42	0.145	0.021	0.002	0.00 (22%)	7	87	33	2
891	173	1085	62	40.65	2.886	1.615	0.255	0.04 (92%)	4	89	35	56
892	1211	3364S	58	295.48	9.661	1.031	0.187	0.09 (28%)	10	89	61	30
893	106	1085	38	53.00	0.811	0.752	0.059	0.02 (78%)	2	89	35	56
894	704	2945	37	85.89	2.751	0.551	0.053	0.03 (13%)	2	89	61	30
898*	36	892L	58	8.78	0.720	0.058	0.006	0.00 (35%)	10	89	61	30
899*	14	892L	58	3.42	0.133	0.009	0.002	0.00 (22%)	10	89	61	30
912	1328	3255S	79	162.02	8.733	3.385	0.719	0.24 (64%)	23	91	75	34
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	39	60
914	838	3100	42	204.47	5.618	0.432	0.073	0.03 (14%)	4	91	65	34
918*	50	912L	79	6.10	0.360	0.115	0.027	0.01 (62%)	23	91	75	34
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	57	72
932	671	1395	67	328.79	10.641	0.914	0.333	0.09 (46%)	8	93	77	52
933	72	1085	36	16.92	1.078	0.605	0.049	0.02 (88%)	2	93	57	72
934	412	3643	16	50.26	1.557	0.293	0.007	0.02 (16%)	2	93	77	52
951	248	4294	23	176.08	5.323	1.394	0.016	0.03 (47%)	3	95	37	58
952	1063	3472S	49	531.50	2.237	2.123	0.114	0.14 (46%)	13	95	63	32
953	111	1240	45	55.50	1.005	0.912	0.093	0.03 (85%)	2	95	42	58
954	537	4340	19	209.43	5.660	0.995	0.011	0.06 (41%)	5	95	63	32
958	50	952L	49	25.00	0.105	0.100	0.005	0.01 (46%)	13	95	63	32

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
aaaa	27	1019	7212.18	227.419	76.812	13.860	4.60	291.40	31.71
			78.25	5.406	0.619	0.101	0.10	16.33	14.47 BUSES
			7133.92	222.013	76.193	13.759	4.50	275.07	32.13 OTHER

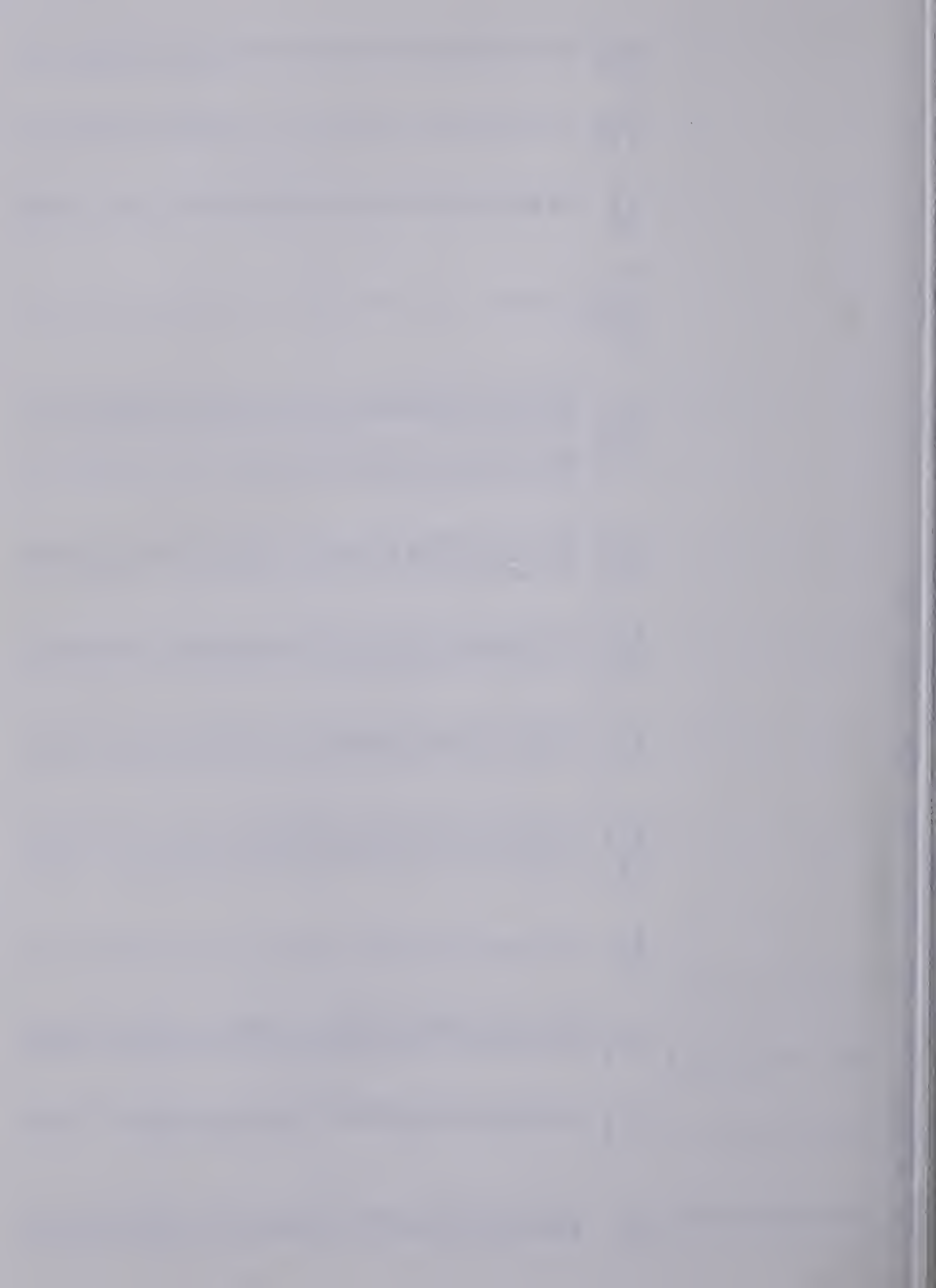
CPU TIME USED 50 FAR IS 12.38 SECS



INTERMEDIATE SETTINGS - STEP SIZES, SO FAR :-

7 17 -1 7 17 1

LINK NUMBER	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
46	4	20	36	7	10	4.736	1.163	0.958	0.08 (65%)	9	46	77	20
48	2	16	3			7.560	0.987	0.124	0.10 (38%)	11	46	25	72
61	2	36	24			3.203	3.073	0.130	0.10 (80%)	9	46	77	14
65	2	3	36			5.889	3.455	0.125	0.12 (58%)	12	46	43	72
76	2	40	26			1.536	0.208	0.017	0.01 (10%)	1	46	77	20
81	2	5	34			4.231	1.761	0.734	0.05 (79%)	5	46	25	42
83	3	35	6	23		0.300	0.290	0.010	0.02 (43%)	1	46	77	40
85	2	35	22			0.722	0.082	0.005	0.00 (36%)	11	46	25	72
87	2	14	1			0.189	0.072	0.029	0.00 (75%)	5	46	25	42
89	2	33	20			1.363	0.495	0.026	0.01 (33%)	1	48	11	32
91	3	37	18	31		3.802	0.457	0.054	0.03 (12%)	4	48	37	6
93	2	33	23			0.927	0.905	0.022	0.03 (75%)	2	48	11	32
95	2	26	13			1.237	1.211	0.025	0.08 (38%)	7	48	37	6
						0.180	0.004	0.002	0.00 (8%)	4	48	37	6
461	447	1550				4.88	0.004	0.002	0.00 (8%)	4	61	77	48
462	925	3410S				88.57	0.707	0.646	0.04 (21%)	5	61	53	72
463	439	3100				41.13	1.224	0.056	0.04 (81%)	3	61	77	48
464	757	4340				124.93	0.631	0.026	0.04 (27%)	3	61	77	6
465	224	2790				103.50	1.773	0.169	0.05 (87%)	4	65	77	6
466	249	1550S				78.93	0.451	0.042	0.03 (19%)	3	65	11	72
467	131	1240				46.69	1.587	0.145	0.05 (89%)	4	65	77	6
468*	36	462L				40.99	0.326	0.009	0.03 (28%)	2	65	11	72
469*	10	466L				143.47	6.281	0.925	0.20 (89%)	17	76	57	80
481	142	2015				70.03	0.684	0.310	0.03 (21%)	3	76	85	52
482	944	4030S				128.47	4.891	0.230	0.14 (89%)	12	76	57	80
483	132	2015				50.63	0.552	0.039	0.04 (31%)	3	76	85	52
484	735	4154				134.44	2.020	1.348	0.11 (69%)	11	81	73	10
488*	40	482L				390.74	1.217	0.353	0.11 (25%)	14	81	15	68
612	726	1395				252.00	3.944	1.004	0.12 (89%)	11	81	73	10
613	175	2015				138.35	1.181	0.018	0.06 (36%)	5	81	15	68
614	512	2759				8.75	0.061	0.008	0.00 (35%)	14	81	15	68
651	207	2015				3.40	0.013	0.003	0.00 (26%)	14	81	15	68
652	647	2682				5.50	0.054	0.000	0.00 (61%)	0	83	17	46
653	197	2015				220.00	1.357	0.131	0.07 (56%)	6	83	51	12
654	336	2666				105.08	3.108	2.512	0.11 (88%)	10	83	17	46
761	806	3519				82.32	1.070	0.050	0.03 (74%)	3	83	73	12
762	574	1395											
763	549	3255											
764	415	2046											
811	577	2387											
812	1608	3875S											
813	504	2170											
814	567	3875											
818*	36	812L											
819*	14	812L											
831	11	1240											
832	440	1550											
833	451	1395											
834	168	1550											



LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	76	151.50	3.019	2.413	0.606	0.07 (88%)	7	83	51	72
837	268	1395	31	62.44	1.990	0.396	0.034	0.04 (54%)	4	83	17	70
838	347	2790	41	170.03	6.521	2.198	0.072	0.07 (78%)	7	83	73	12
852	1421	3472S	65	554.19	14.599	1.991	0.292	0.11 (29%)	11	85	75	44
854	549	4340	19	133.41	3.845	0.499	0.012	0.03 (19%)	3	85	75	44
858*	36	852L	65	14.04	1.149	0.085	0.007	0.01 (52%)	11	85	75	44
859*	14	852L	65	5.46	0.224	0.027	0.003	0.00 (36%)	11	85	75	44
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	7	28
872	1245	3348S	59	303.78	10.101	1.213	0.209	0.07 (20%)	7	87	33	2
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	7	28
874	613	3379	28	149.57	5.248	1.482	0.027	0.11 (63%)	10	87	33	2
878*	36	872L	59	8.78	0.730	0.079	0.006	0.00 (46%)	7	87	33	2
879*	14	872L	59	3.42	0.143	0.018	0.002	0.00 (20%)	7	87	33	2
891	173	1085	62	40.65	3.192	1.921	0.255	0.04 (91%)	4	89	45	66
892	1211	3364S	58	295.48	10.280	1.650	0.187	0.16 (48%)	16	89	71	40
893	106	1085	38	53.00	0.811	0.752	0.059	0.02 (78%)	2	89	45	66
894	704	2945	37	85.89	2.472	0.272	0.053	0.01 (6%)	1	89	71	40
898*	36	892L	58	8.78	0.715	0.054	0.006	0.00 (40%)	16	89	71	40
899*	14	892L	58	3.42	0.139	0.015	0.002	0.00 (44%)	16	89	71	40
912	1328	3255S	79	162.02	7.750	2.402	0.719	0.12 (31%)	19	91	77	36
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	41	62
914	838	3100	42	204.47	5.816	0.631	0.073	0.09 (37%)	10	91	67	36
918*	50	912L	79	6.10	0.352	0.107	0.027	0.00 (32%)	19	91	77	36
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	51	66
932	671	1395	67	328.79	10.530	0.803	0.333	0.08 (42%)	8	93	71	46
933	72	1085	36	16.92	1.062	0.590	0.049	0.02 (86%)	2	93	51	66
934	412	3643	16	50.26	1.650	0.386	0.007	0.03 (23%)	2	93	71	46
951	248	4294	23	176.08	5.536	1.606	0.016	0.04 (52%)	3	95	31	52
952	1063	3472S	49	531.50	2.237	2.123	0.114	0.14 (46%)	13	95	57	26
953	111	1240	45	55.50	1.005	0.912	0.093	0.03 (85%)	2	95	36	52
954	537	4340	19	209.43	5.736	1.071	0.011	0.06 (42%)	6	95	57	26
958	50	952L	49	25.00	0.105	0.100	0.005	0.01 (46%)	13	95	57	26

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
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&aaaa	42	1314	7212.18	226.504	75.897	13.860	4.47	282.30	31.84
			78.25	5.404	0.617	0.101	0.09	16.20	14.48 BUSES
			7133.92	221.100	75.281	13.759	4.37	266.11	32.27 OTHER

CPU TIME USED SO FAR IS 14.93 SECS

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17 -1 7 17 1 -1

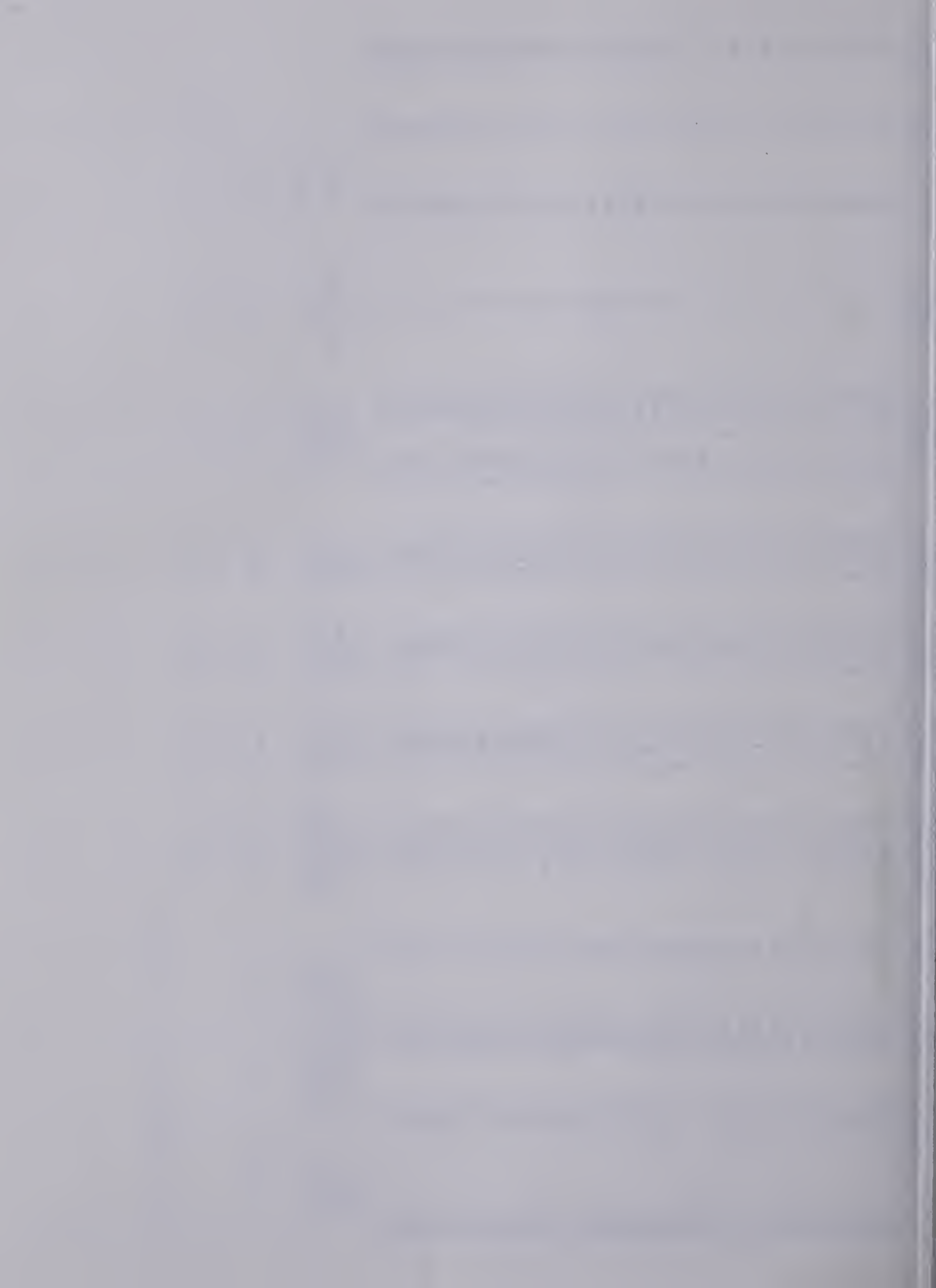
LINK NUMBER	NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
461	46	4	20	36	7	10				1.163	0.958	0.08 (65%)	9	46	77	20
462	48	2	16	3						0.988	0.124	0.10 (38%)	11	46	25	72
463	61	2	36	24						3.073	0.130	0.10 (80%)	9	46	77	14
464	65	2	3	36						3.455	0.125	0.12 (58%)	12	46	43	72
465	76	2	40	26						0.208	0.017	0.01 (10%)	1	46	77	20
466	81	2	5	34						1.763	0.734	0.05 (79%)	5	46	25	42
467	83	3	34	5	22					0.290	0.010	0.02 (43%)	1	46	77	40
468*	85	2	35	22						0.082	0.005	0.00 (36%)	11	46	25	72
469*	87	2	14	1						0.072	0.029	0.00 (75%)	5	46	25	42
481	89	2	33	20						0.495	0.026	0.01 (33%)	1	48	11	32
482	91	3	37	18	31					0.457	0.054	0.03 (12%)	4	48	37	6
483	93	2	33	23						0.905	0.022	0.03 (75%)	2	48	11	32
484	95	2	26	12						1.211	0.025	0.08 (38%)	7	48	37	6
488*										0.004	0.002	0.00 (8%)	4	48	37	6
612										0.681	0.646	0.04 (20%)	4	61	77	48
613										1.223	0.056	0.04 (81%)	3	61	53	72
614										0.631	0.026	0.04 (27%)	3	61	77	48
651										1.773	0.169	0.05 (87%)	4	65	77	6
652										0.451	0.042	0.03 (19%)	3	65	11	72
653										1.587	0.145	0.05 (89%)	4	65	77	6
654										0.326	0.009	0.03 (28%)	2	65	11	72
761										6.281	0.925	0.20 (89%)	17	76	57	80
762										0.664	0.310	0.03 (20%)	3	76	85	52
763										4.891	0.230	0.14 (89%)	12	76	57	80
764										0.552	0.039	0.04 (31%)	3	76	85	52
811										1.897	1.348	0.12 (75%)	12	81	73	10
812										1.215	0.353	0.11 (24%)	12	81	15	68
813										3.944	1.004	0.12 (89%)	11	81	73	10
814										1.181	0.018	0.06 (36%)	5	81	15	68
818*										0.060	0.008	0.00 (34%)	12	81	15	68
819*										0.013	0.003	0.00 (26%)	12	81	15	68
831										0.054	0.000	0.00 (61%)	0	83	15	44
832										1.357	0.131	0.07 (56%)	6	83	49	10
833										3.163	2.512	0.11 (88%)	10	83	15	44
834										1.068	0.050	0.03 (73%)	3	83	71	10

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	76	151.50	3.019	2.413	0.606	0.07 (88%)	7	83	49	70
837	268	1395	31	62.44	1.936	0.342	0.034	0.03 (47%)	4	83	15	68
838	347	2790	41	170.03	6.470	2.148	0.072	0.07 (77%)	6	83	71	10
852	1421	3472S	65	554.19	14.471	1.864	0.292	0.10 (26%)	11	85	75	44
854	549	4340	19	133.41	3.845	0.498	0.012	0.03 (18%)	3	85	75	44
858*	36	852L	65	14.04	1.149	0.085	0.007	0.01 (51%)	11	85	75	44
859*	14	852L	65	5.46	0.224	0.026	0.003	0.00 (34%)	11	85	75	44
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	7	28
872	1245	3348S	59	303.78	10.117	1.229	0.209	0.07 (20%)	7	87	33	2
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	7	28
874	613	3379	28	149.57	5.248	1.482	0.027	0.11 (63%)	10	87	33	2
878*	36	872L	59	8.78	0.730	0.080	0.006	0.00 (47%)	7	87	33	2
879*	14	872L	59	3.42	0.144	0.019	0.002	0.00 (20%)	7	87	33	2
891	173	1085	62	40.65	3.192	1.921	0.255	0.04 (91%)	4	89	45	66
892	1211	3364S	58	295.48	10.278	1.648	0.187	0.16 (48%)	16	89	71	40
893	106	1085	38	53.00	0.811	0.752	0.059	0.02 (78%)	2	89	45	66
894	704	2945	37	85.89	2.472	0.272	0.053	0.01 (6%)	1	89	71	40
898*	36	892L	58	8.78	0.715	0.053	0.006	0.00 (40%)	16	89	71	40
899*	14	892L	58	3.42	0.139	0.015	0.002	0.00 (45%)	16	89	71	40
912	1328	3255S	79	162.02	7.771	2.422	0.719	0.12 (32%)	19	91	77	36
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	41	62
914	838	3100	42	204.47	5.816	0.631	0.073	0.09 (37%)	10	91	67	36
918*	50	912L	79	6.10	0.353	0.108	0.027	0.00 (32%)	19	91	77	36
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	51	66
932	671	1395	67	328.79	10.580	0.853	0.333	0.08 (44%)	8	93	71	46
933	72	1085	36	16.92	1.062	0.590	0.049	0.02 (86%)	2	93	51	66
934	412	3643	16	50.26	1.650	0.386	0.007	0.03 (23%)	2	93	71	46
951	248	4294	21	176.08	5.355	1.429	0.013	0.03 (48%)	3	95	29	52
952	1063	3472S	51	531.50	2.552	2.425	0.127	0.15 (49%)	14	95	57	24
953	111	1240	41	55.50	0.928	0.859	0.069	0.03 (82%)	2	95	34	52
954	537	4340	20	209.43	5.920	1.254	0.012	0.07 (47%)	6	95	57	24
958	50	952L	51	25.00	0.120	0.114	0.006	0.01 (49%)	14	95	57	24

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
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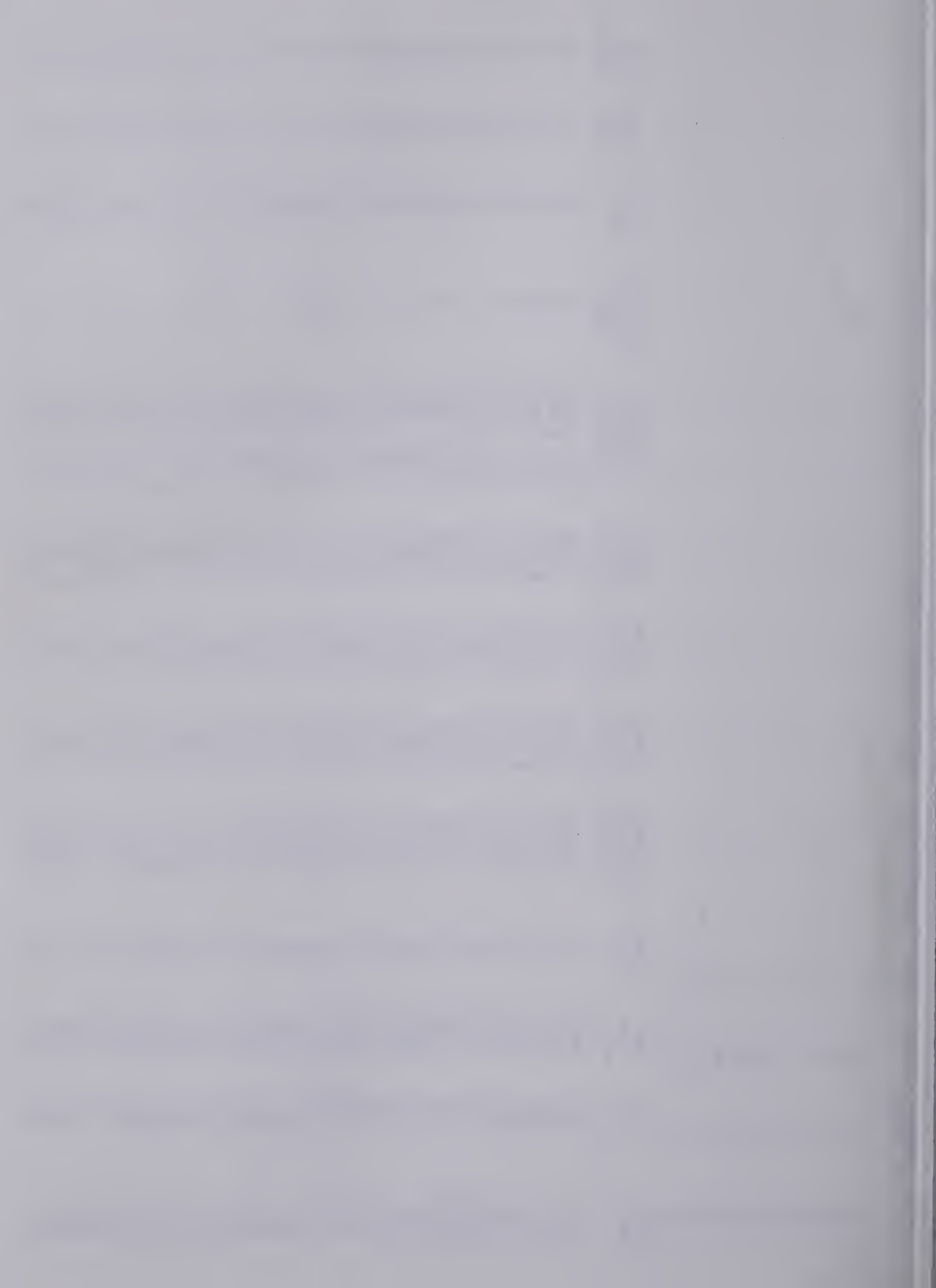
aaaa	32	964	7212.18	226.498	75.904	13.848	4.38	281.74	31.84
			78.25	5.405	0.617	0.101	0.09	16.18	14.48 BUSES
			7133.92	221.093	75.287	13.747	4.29	265.55	32.27 OTHER

CPU TIME USED SO FAR IS 16.88 SECS



FINAL SETTINGS OBTAINED WITH STEP SIZES : - 7 17 -1 7 17 1 -1 1

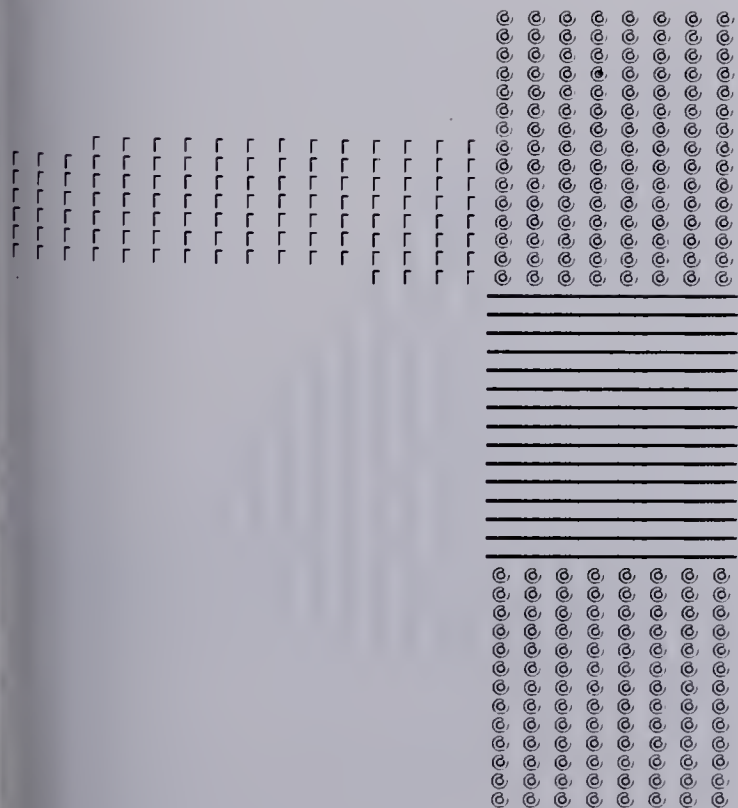
LINK NUMBER	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
46	4	20	36	7	10				1.163	0.958	0.08 (65%)	9	46	77	20
48	2	16	3						0.987	0.124	0.10 (38%)	11	46	25	72
61	2	35	23						3.073	0.130	0.10 (80%)	9	46	77	14
65	2	3	36						3.455	0.125	0.12 (58%)	12	46	43	72
76	2	40	26						0.208	0.017	0.01 (10%)	1	46	77	20
81	2	5	34						1.761	0.734	0.05 (79%)	5	46	25	42
83	3	33	4	21					0.290	0.010	0.02 (43%)	1	46	77	40
85	2	35	22						0.082	0.005	0.00 (36%)	11	46	25	72
87	2	14	1						0.072	0.029	0.00 (76%)	5	46	25	42
89	2	33	20						0.496	0.026	0.01 (33%)	1	48	11	32
91	3	37	18	31					0.457	0.054	0.03 (12%)	4	48	37	6
93	2	32	22						0.905	0.022	0.03 (75%)	2	48	11	32
95	2	25	11						1.211	0.025	0.08 (38%)	7	48	37	6
461	447	1550	83		104.60	4.736			0.004	0.002	0.00 (8%)	4	48	37	6
462	925	3410S	50		225.70	7.559			0.683	0.646	0.04 (20%)	4	61	75	46
463	439	3100	51		103.16	3.203			1.185	0.056	0.04 (80%)	3	61	51	70
464	757	4340	50		92.35	5.889			0.665	0.026	0.04 (29%)	4	61	75	46
465	224	2790	23		52.42	1.536			1.773	0.169	0.05 (87%)	4	65	77	6
466	249	1550S	80		60.76	4.231			0.450	0.042	0.03 (19%)	3	65	11	72
467	131	1240	18		30.78	0.300			1.587	0.145	0.05 (89%)	4	65	77	6
468*	36	462L	50		8.78	0.722			0.326	0.009	0.03 (28%)	2	65	11	72
469*	10	466L	80		2.44	0.189			6.281	0.925	0.20 (89%)	17	76	57	80
481	142	2015	28		33.65	1.364			0.601	0.310	0.03 (21%)	4	76	85	52
482	944	4030S	37		115.17	3.802			4.891	0.230	0.14 (89%)	12	76	57	80
483	132	2015	26		31.02	0.927			0.552	0.039	0.04 (31%)	3	76	85	52
484	735	4154	27		89.67	1.237			1.845	1.348	0.13 (80%)	12	81	73	10
488*	40	482L	37		4.88	0.180			1.209	0.353	0.11 (25%)	14	81	15	68
612	726	1395	77		88.57	3.860			3.944	1.004	0.12 (89%)	11	81	73	10
613	175	2015	37		41.13	2.268			1.181	0.018	0.06 (36%)	5	81	15	68
614	512	2759	28		124.93	3.204			0.060	0.008	0.00 (34%)	14	81	15	68
651	207	2015	55		103.50	1.943			0.013	0.003	0.00 (25%)	14	81	15	68
652	647	2682	33		78.93	2.747			0.054	0.000	0.00 (61%)	0	83	13	42
653	197	2015	53		46.69	2.899			1.357	0.131	0.07 (56%)	6	83	47	8
654	336	2666	17		40.99	0.335			3.234	2.512	0.11 (89%)	10	83	13	42
761	806	3519	82		143.47	7.206			1.072	0.050	0.03 (74%)	3	83	69	8
762	574	1395	66		70.03	2.912									
763	549	3255	60		128.47	8.333									
764	415	2046	32		50.63	1.857									
811	577	2387	87		134.44	6.553									
812	1608	3875S	68		390.74	12.726									
813	504	2170	83		252.00	4.948									
814	567	3875	23		138.35	4.658									
818*	36	812L	68		8.75	0.722									
819*	14	812L	68		3.40	0.137									
831	11	1240	3		5.50	0.054									
832	440	1550	51		220.00	1.488									
833	451	1395	93		105.08	8.373									
834	168	1550	36		82.32	3.180									



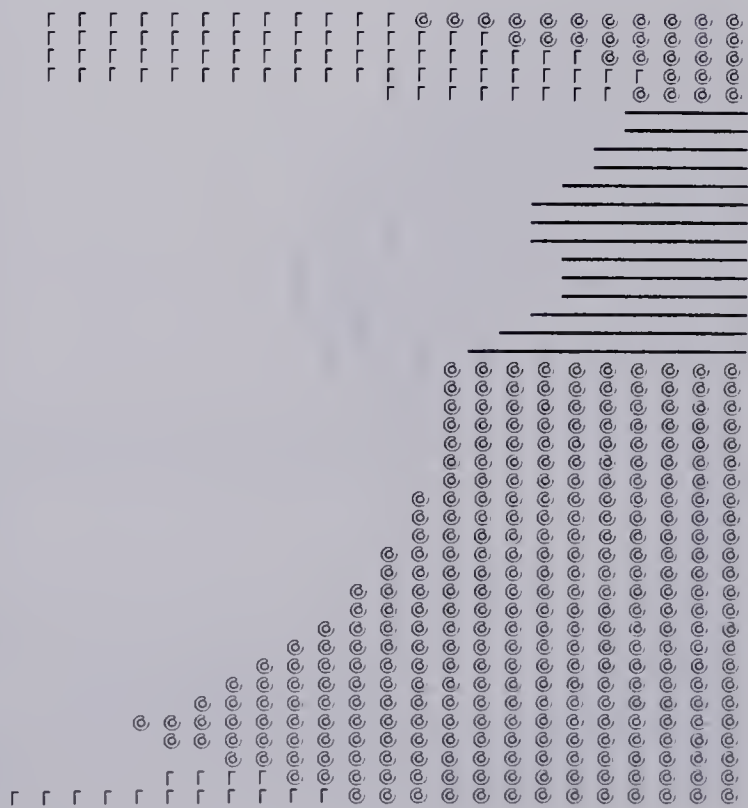
LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	76	151.50	3.019	2.413	0.606	0.07 (88%)	7	83	47	68
837	268	1395	31	62.44	1.883	0.288	0.034	0.03 (39%)	3	83	13	66
838	347	2790	41	170.03	6.483	2.160	0.072	0.07 (77%)	6	83	69	8
852	1421	3472S	65	554.19	14.363	1.756	0.292	0.10 (26%)	11	85	75	44
854	549	4340	19	133.41	3.844	0.498	0.012	0.03 (18%)	3	85	75	44
858*	36	852L	65	14.04	1.148	0.083	0.007	0.01 (51%)	11	85	75	44
859*	14	852L	65	5.46	0.222	0.024	0.003	0.00 (32%)	11	85	75	44
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	7	28
872	1245	3348S	59	303.78	10.098	1.210	0.209	0.07 (20%)	7	87	33	2
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	7	28
874	613	3379	28	149.57	5.250	1.484	0.027	0.11 (63%)	10	87	33	2
878*	36	872L	59	8.78	0.730	0.079	0.006	0.00 (46%)	7	87	33	2
879*	14	872L	59	3.42	0.143	0.018	0.002	0.00 (20%)	7	87	33	2
891	173	1085	62	40.65	3.151	1.880	0.255	0.04 (88%)	4	89	45	66
892	1211	3364S	58	295.48	10.280	1.650	0.187	0.16 (48%)	16	89	71	40
893	106	1085	38	53.00	0.811	0.752	0.059	0.02 (78%)	2	89	45	66
894	704	2945	37	85.89	2.472	0.272	0.053	0.01 (6%)	1	89	71	40
898*	36	892L	58	8.78	0.715	0.054	0.006	0.00 (40%)	16	89	71	40
899*	14	892L	58	3.42	0.139	0.014	0.002	0.00 (43%)	16	89	71	40
912	1328	3255S	79	162.02	7.743	2.395	0.719	0.12 (31%)	19	91	77	36
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	41	62
914	838	3100	42	204.47	5.816	0.631	0.073	0.09 (37%)	10	91	67	36
918*	50	912L	79	6.10	0.353	0.108	0.027	0.00 (32%)	19	91	77	36
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	49	64
932	671	1395	67	328.79	10.580	0.853	0.333	0.08 (44%)	8	93	69	44
933	72	1085	36	16.92	1.078	0.605	0.049	0.02 (88%)	2	93	49	64
934	412	3643	16	50.26	1.650	0.386	0.007	0.03 (23%)	2	93	69	44
951	248	4294	21	176.08	5.355	1.428	0.013	0.03 (48%)	3	95	27	50
952	1063	3472S	51	531.50	2.552	2.425	0.127	0.15 (49%)	14	95	55	22
953	111	1240	41	55.50	0.928	0.859	0.069	0.03 (82%)	2	95	32	50
954	537	4340	20	209.43	5.960	1.294	0.012	0.07 (49%)	6	95	55	22
958	50	952L	51	25.00	0.120	0.114	0.006	0.01 (49%)	14	95	55	22

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
kaaaa	31	978	7212.18	226.262	75.668	13.848	4.39	280.73	31.88
			78.25	5.400	0.612	0.101	0.09	16.07	14.49 BUSES
			7133.92	220.862	75.055	13.747	4.30	264.66	32.30 OTHER

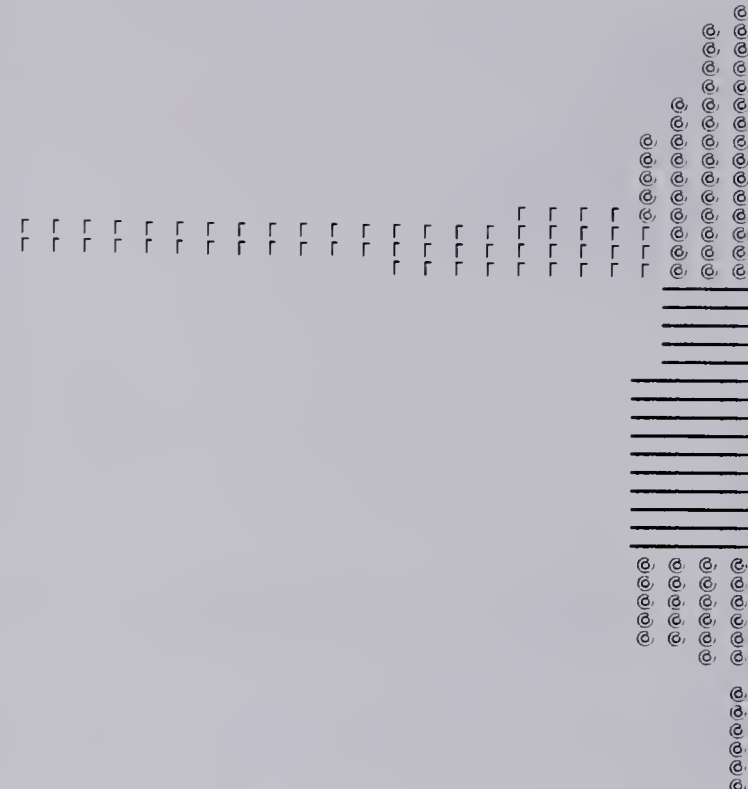
CPU TIME USED 50 FAR IS 18.84 SECS



LINK 852 MAX FLOW 3380 VEH/H M.M.E. 0.35

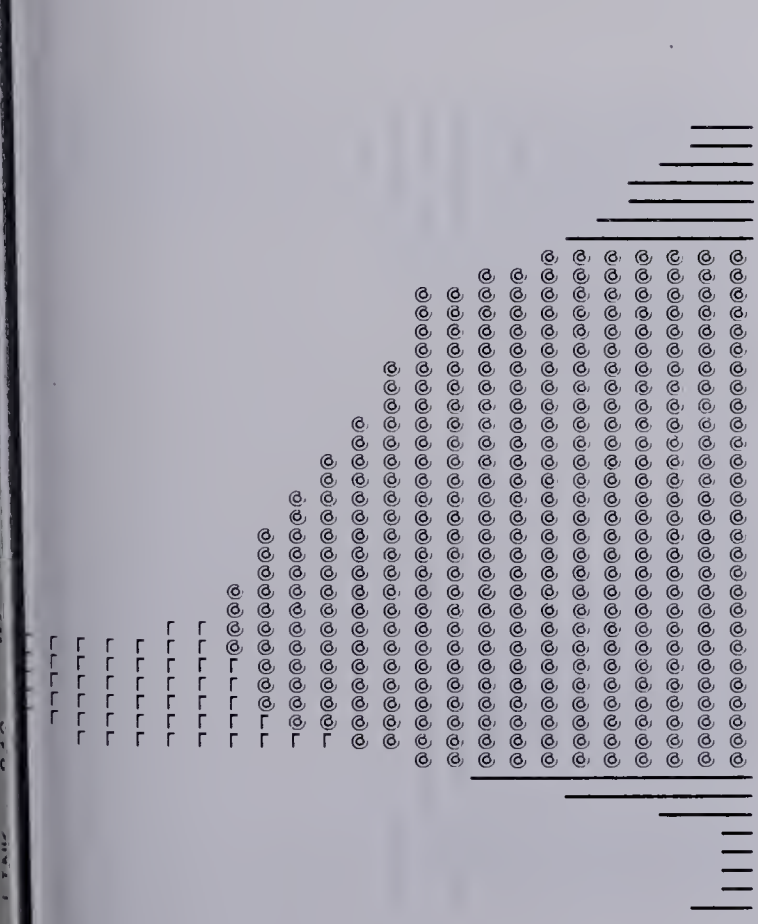


LINK 954 MAX FLOW 4340 VEH/H M.M.E. 0.35

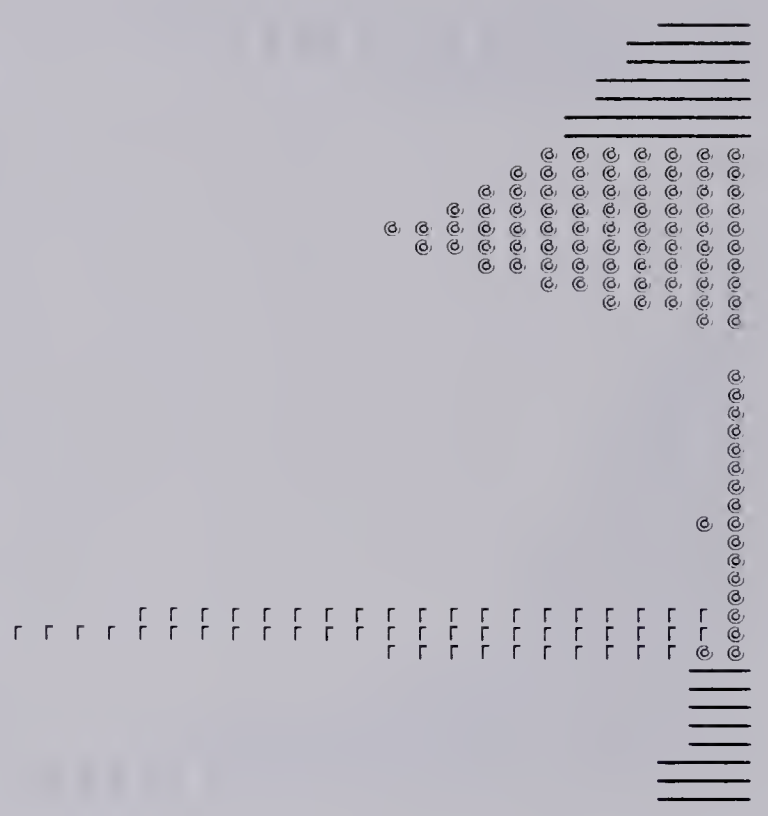




LINK 814 MAX FLOW 3875 VEH/H M.M.E. 0.73

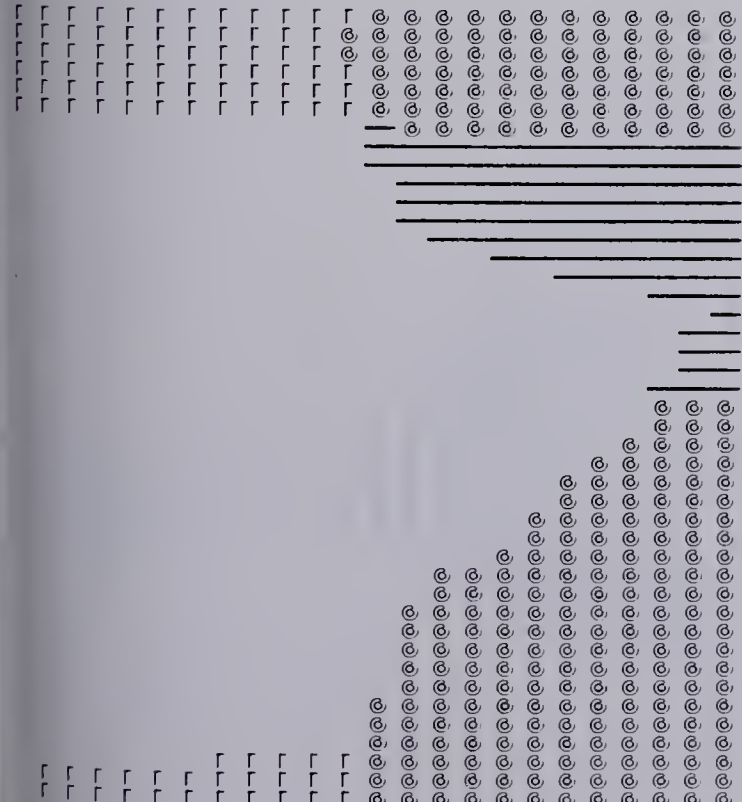
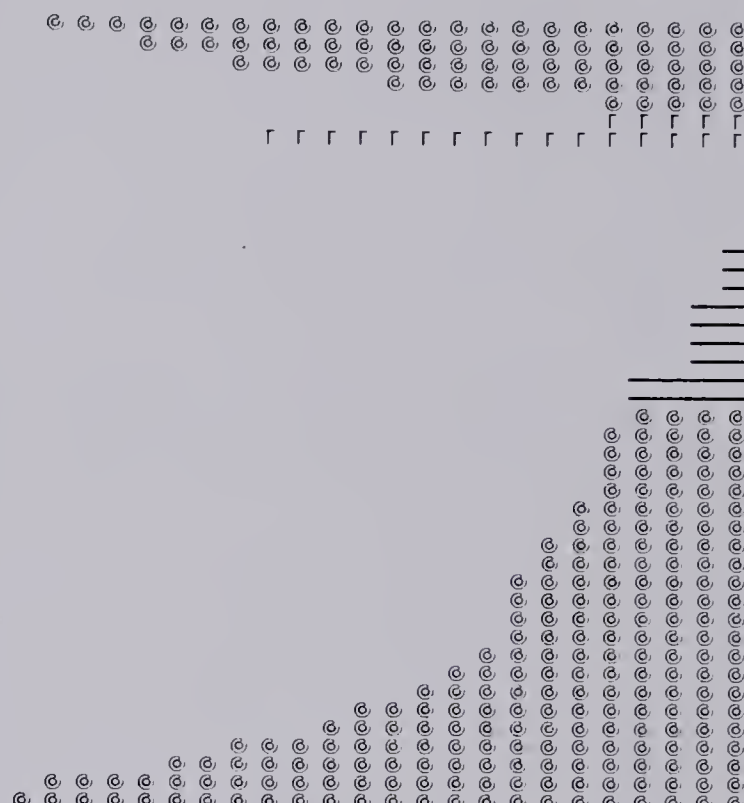


LINK 872 MAX FLOW 3131 VEH/H M.M.E. 0.40

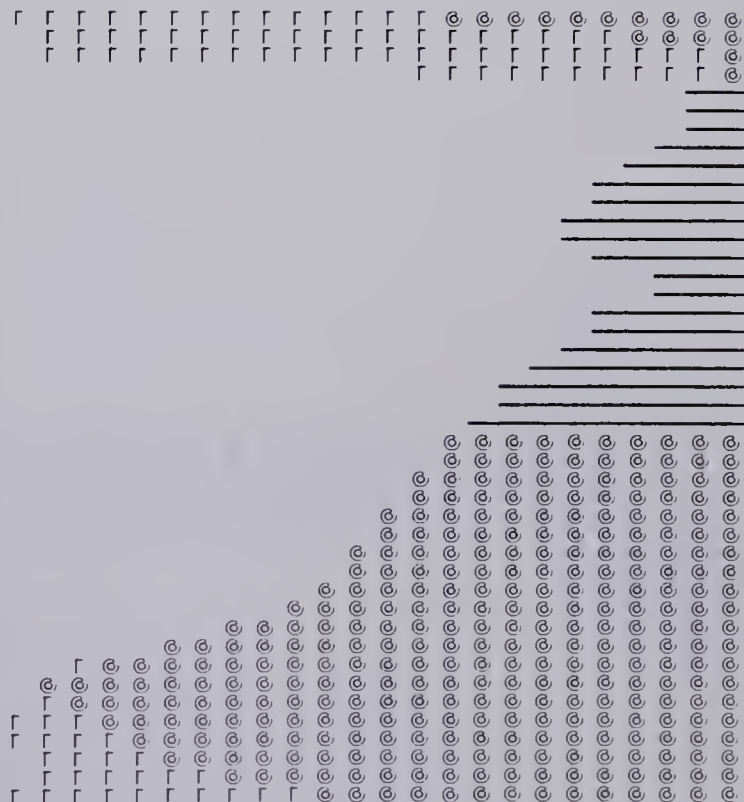


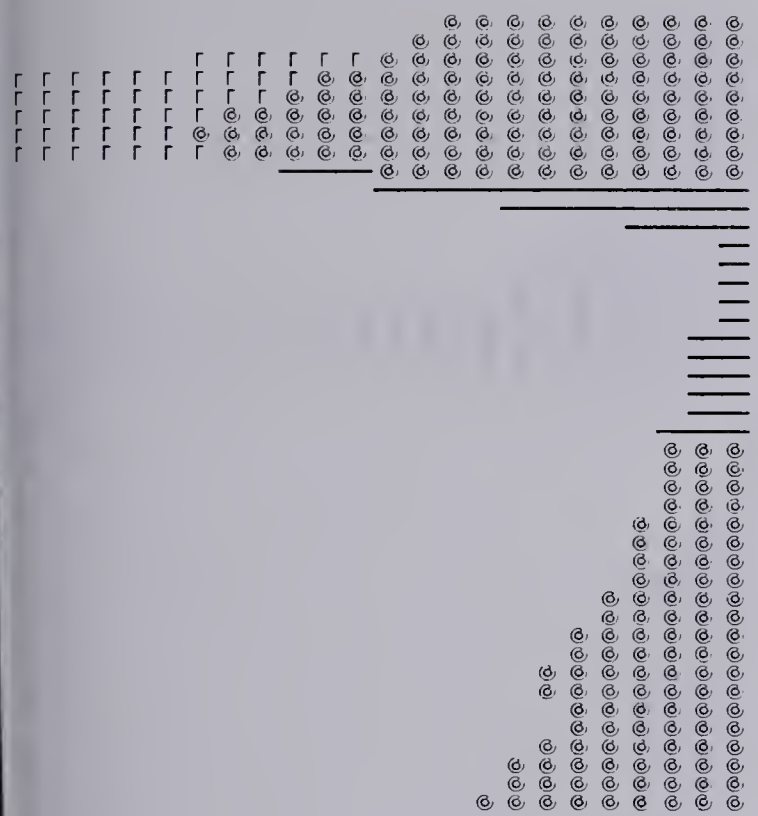


LINK 894 MAX FLOW 2274 VEH/H M.M.E. 0.73

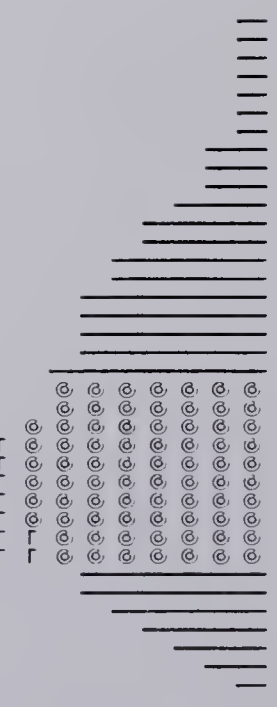
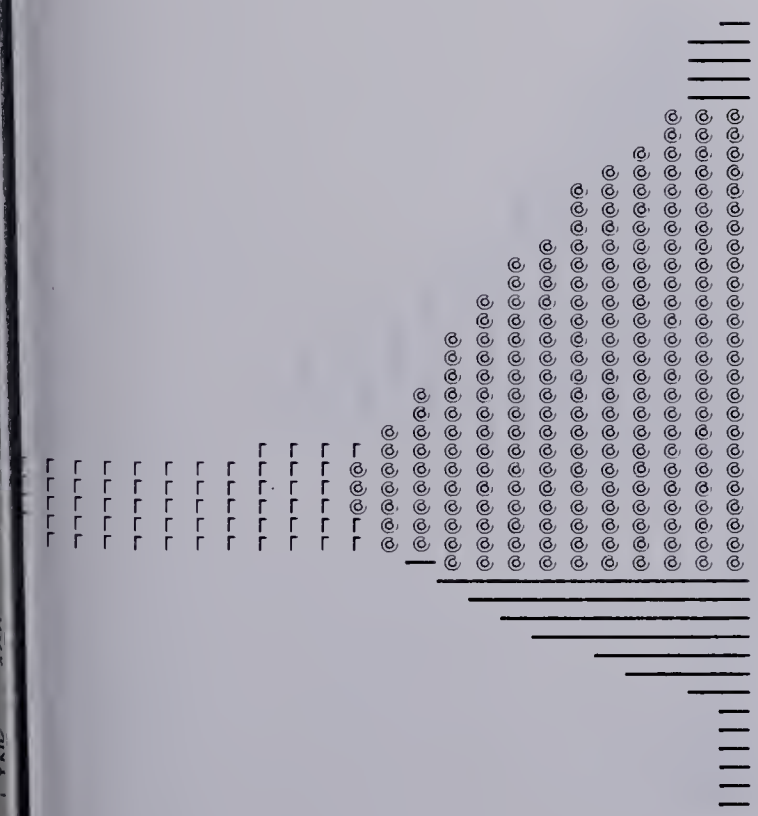


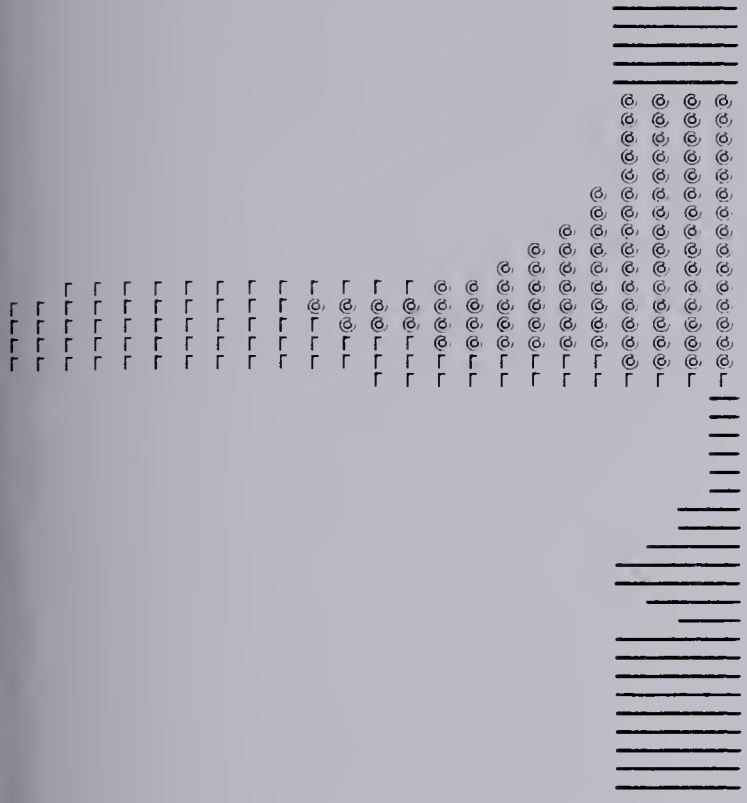
LINK 912 MAX FLOW 3235 VEH/H M.M.E. 0.56



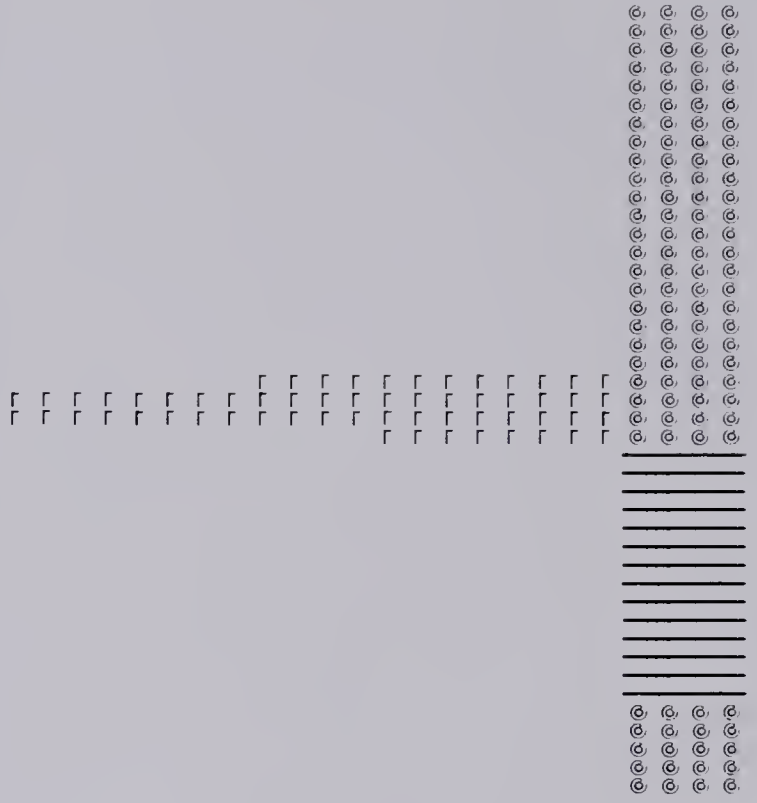


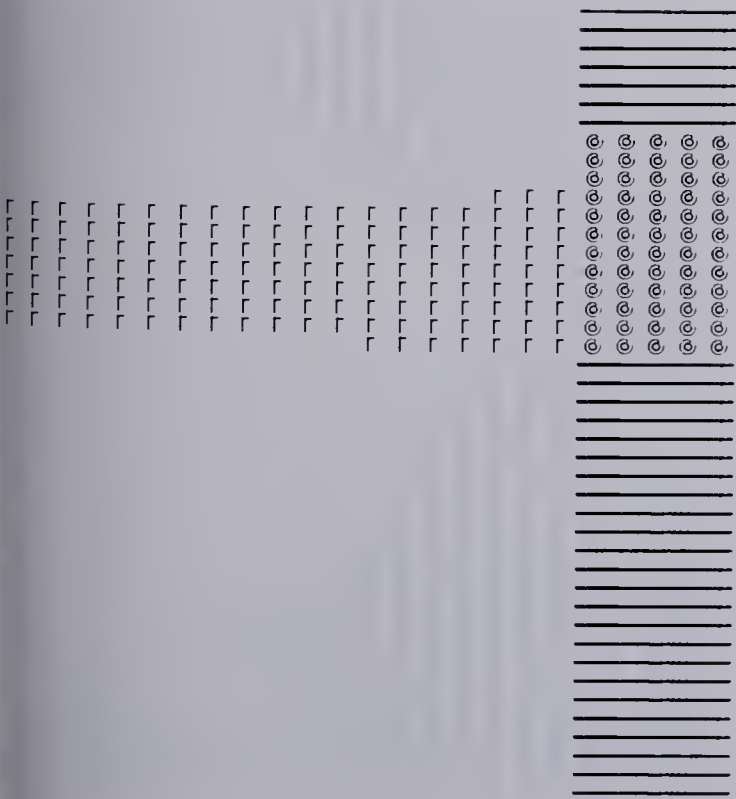
LINK 466 MAX FLOW 1519 VEH/H M.M.E. 0.66



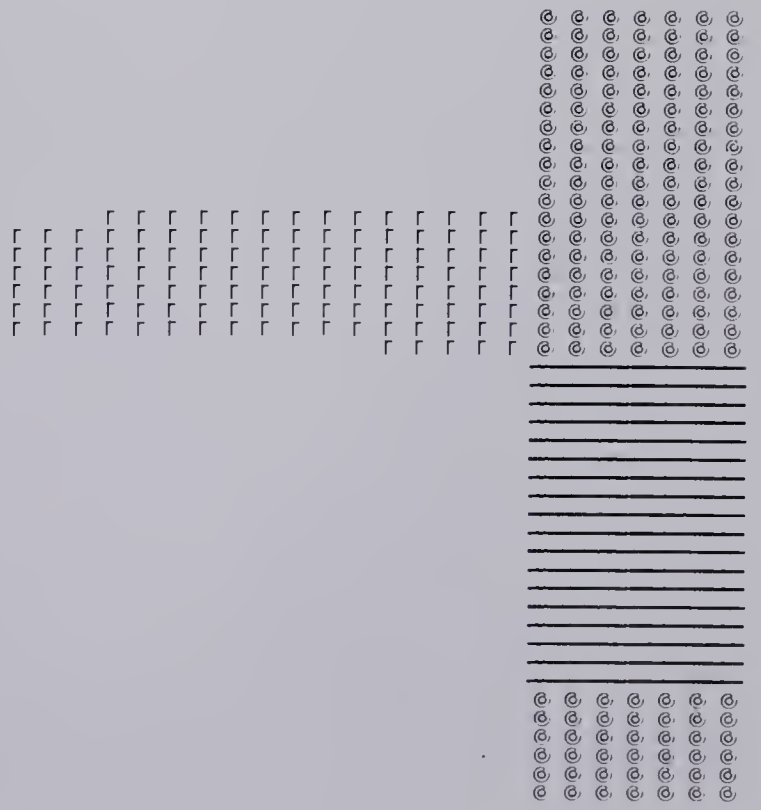


LINK 484 MAX FLOW 4154 VEH/H M.M.E. 0.0

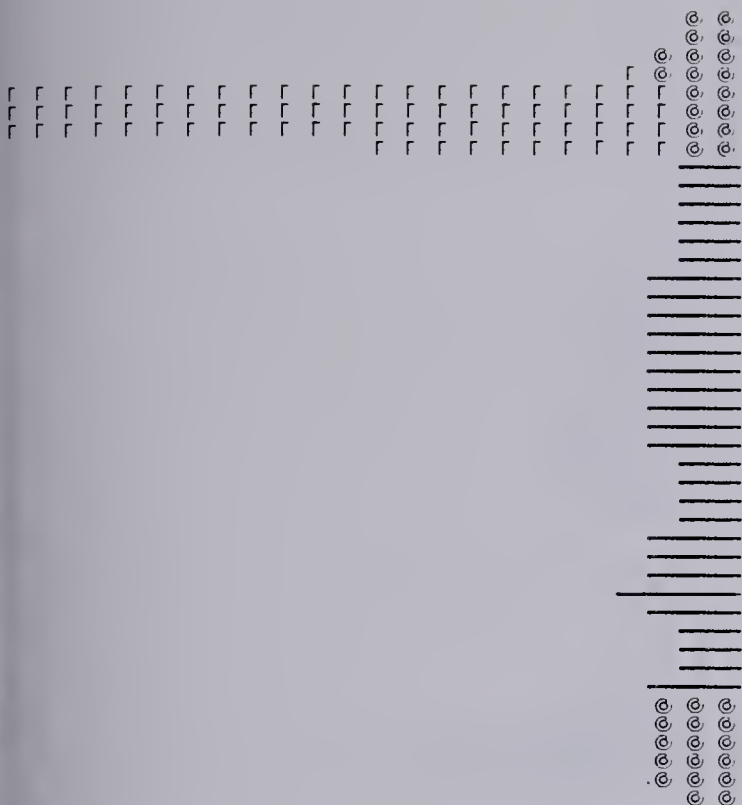




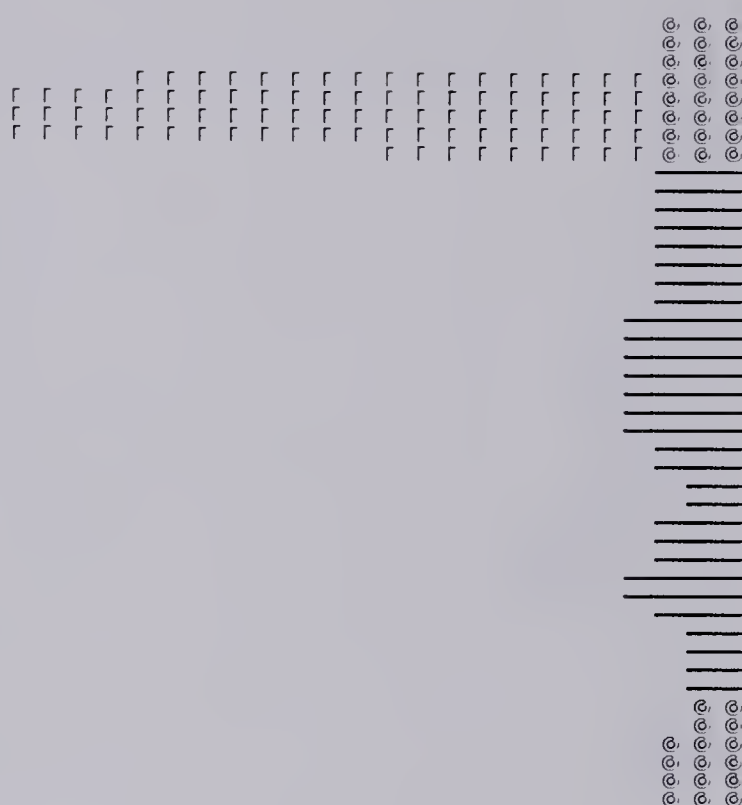
LINK 832 MAX FLOW 1550 VEH/H M.M.E. O.O

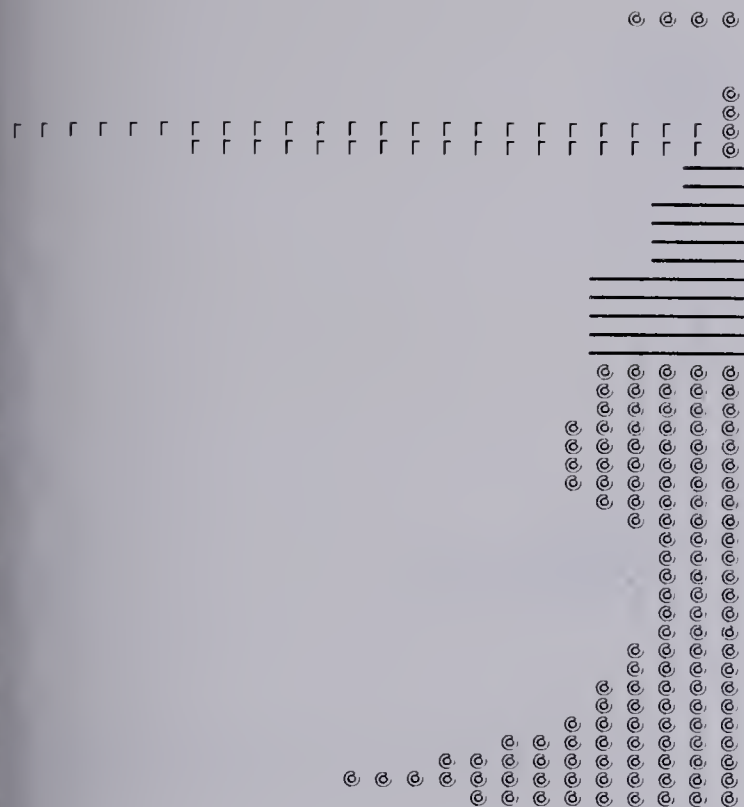






LINK 838 MAX FLOW 2790 VEH/H M.M.E. 0.15

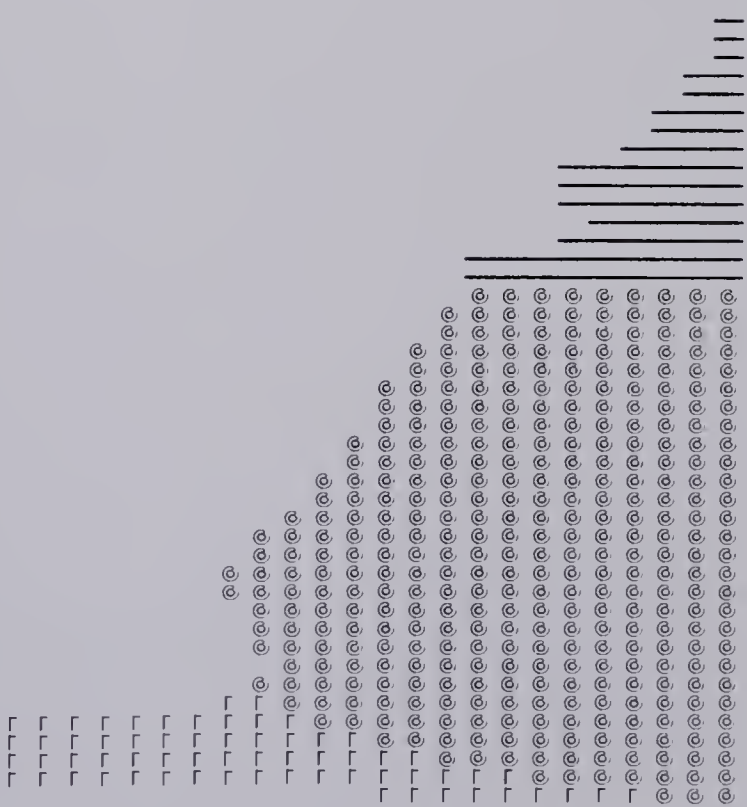




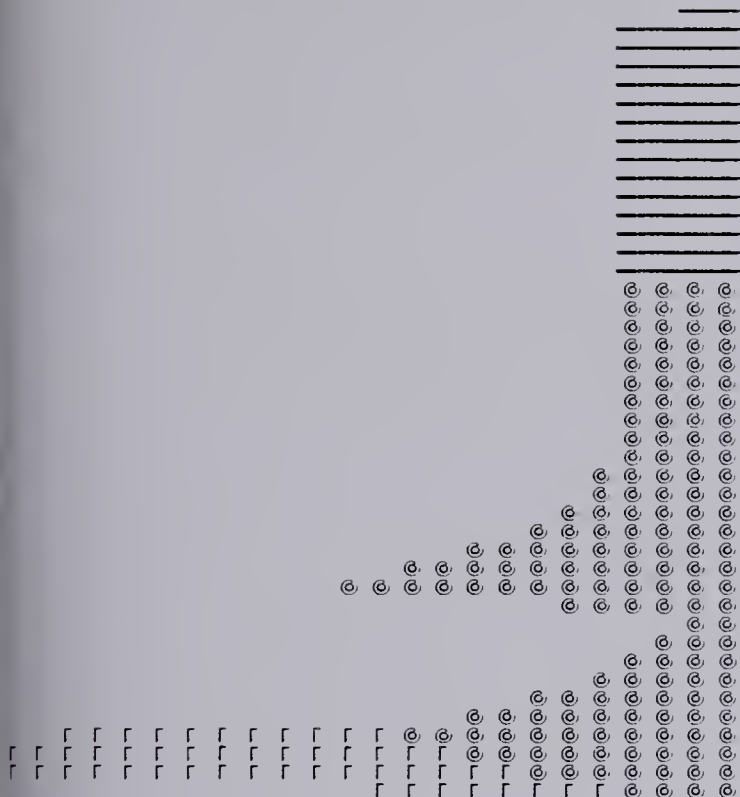
LINK 614 MAX FLOW 2759 VEH/H M.M.E. 0.28



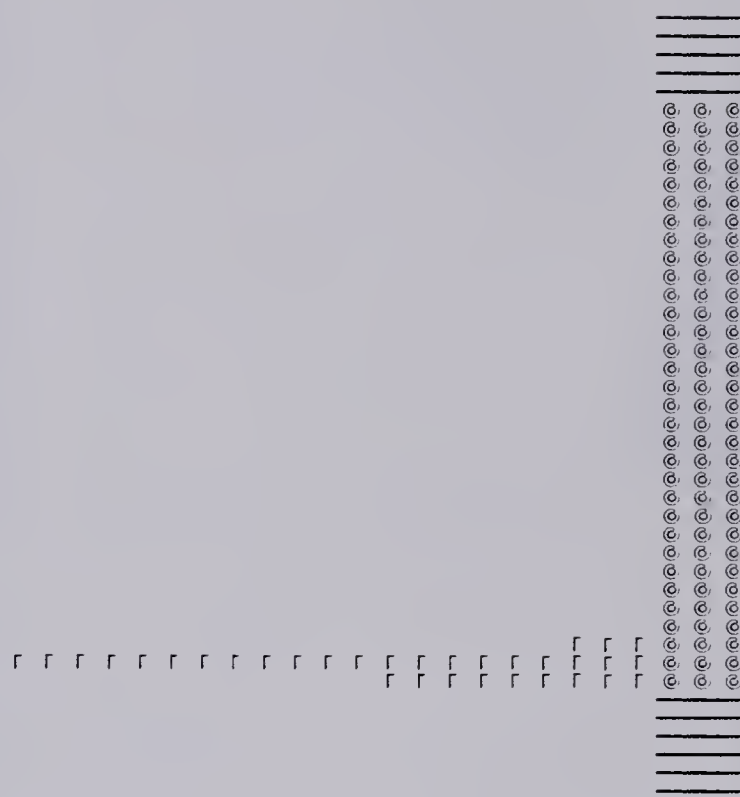
LINK 762 MAX FLOW 1395 VEH/H M.M.E. 0.45

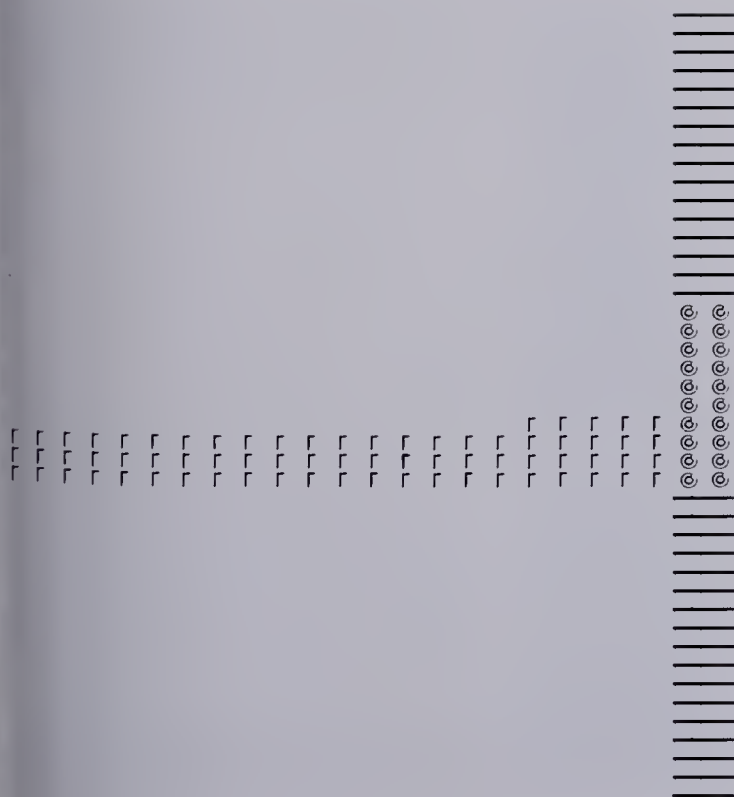




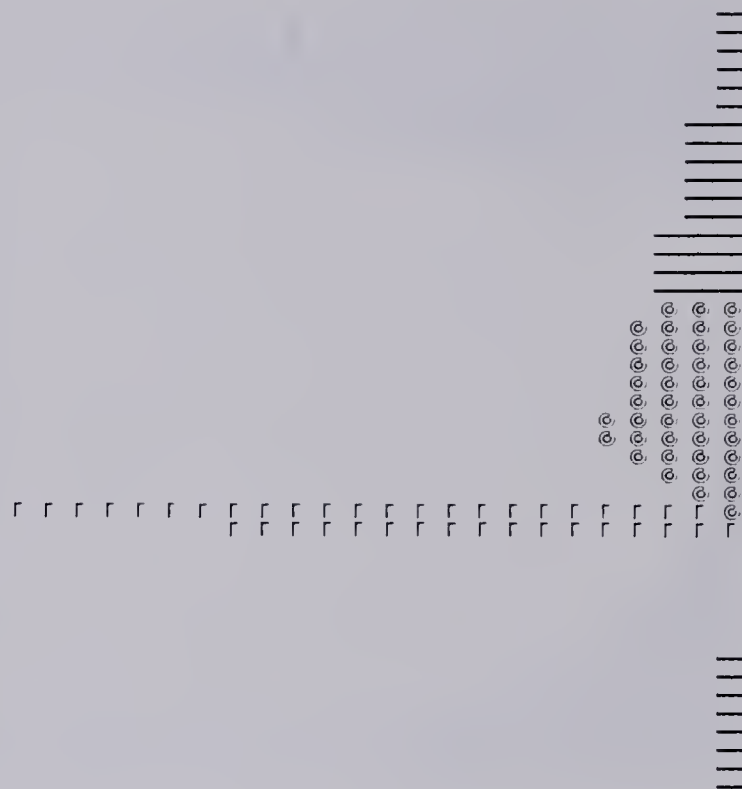


LINK 654 MAX FLOW 2666 VEH/H M.M.E. O.O



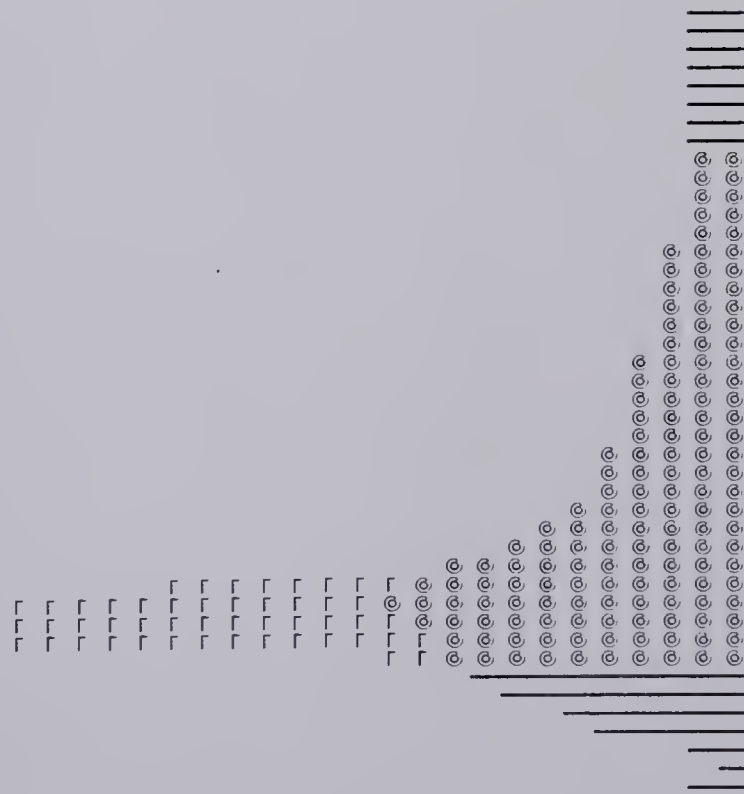


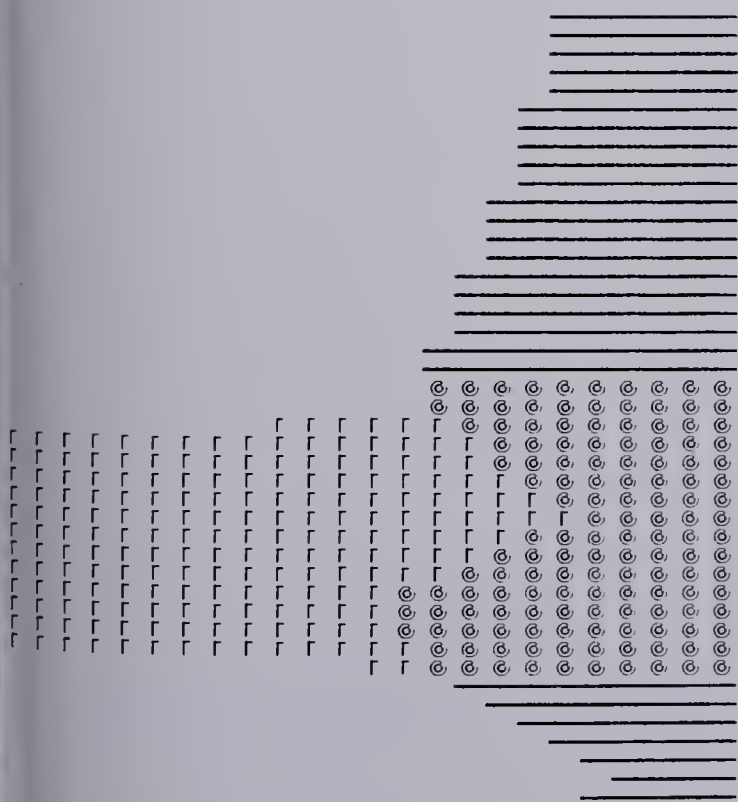
LINK 951 MAX FLOW 3089 VEH/H M.M.E. 0.64



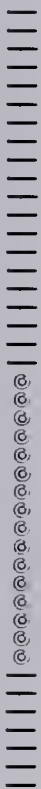
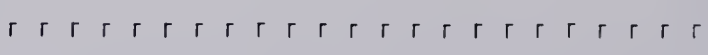


LINK 837 MAX FLOW 1395 VEH/H M.M.E. 0.55

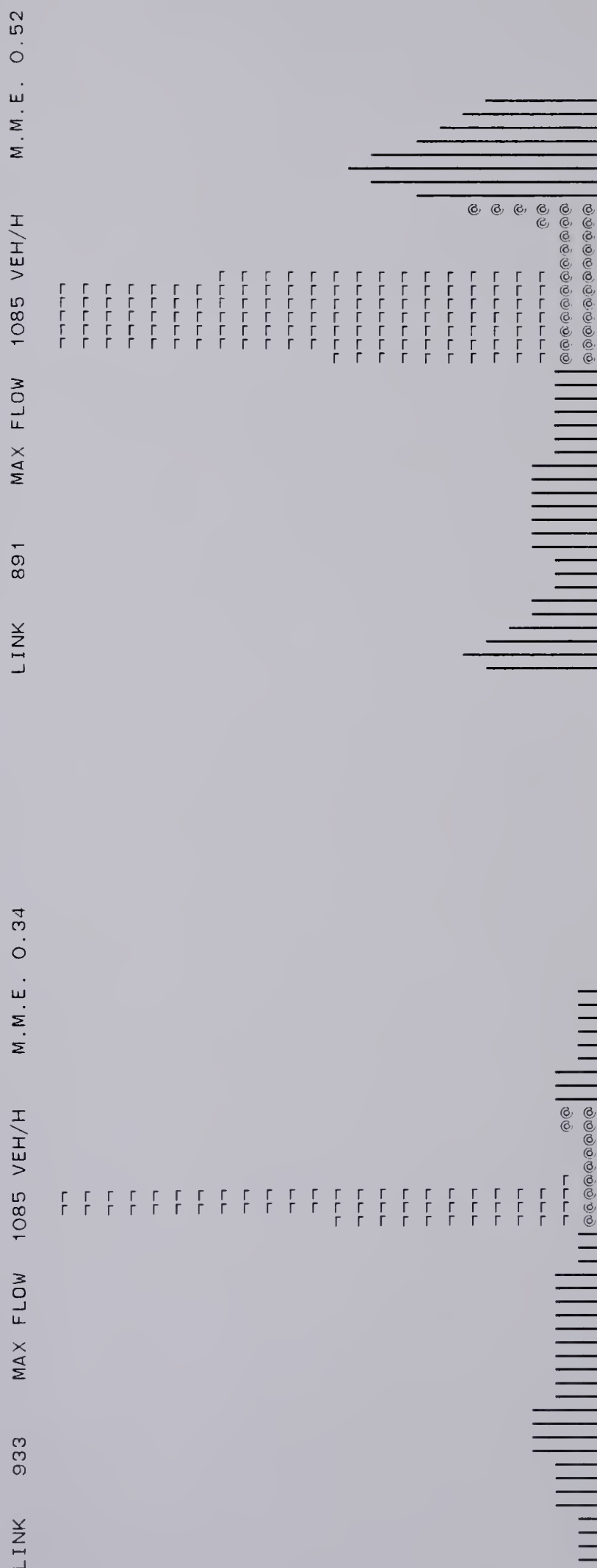
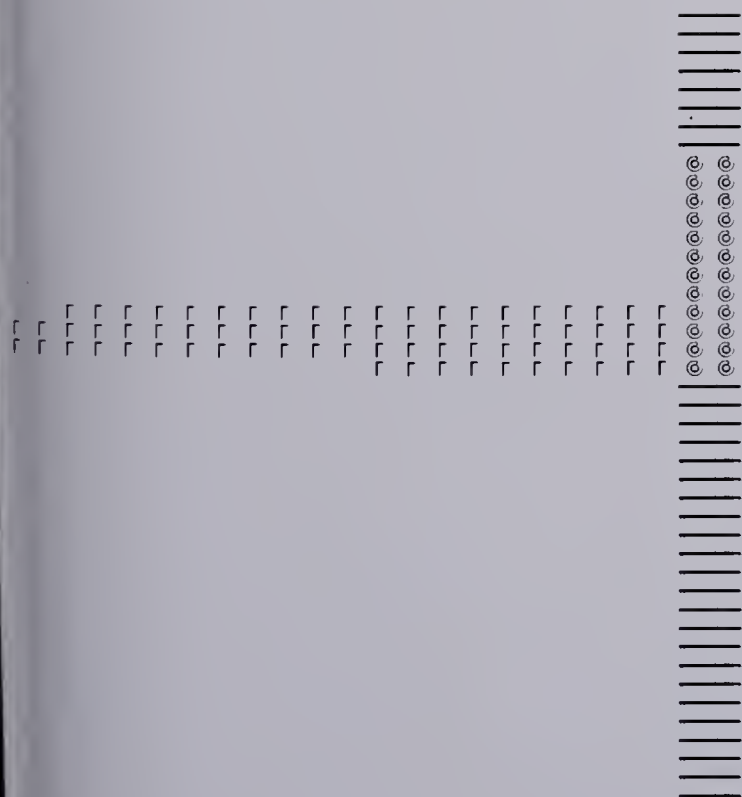




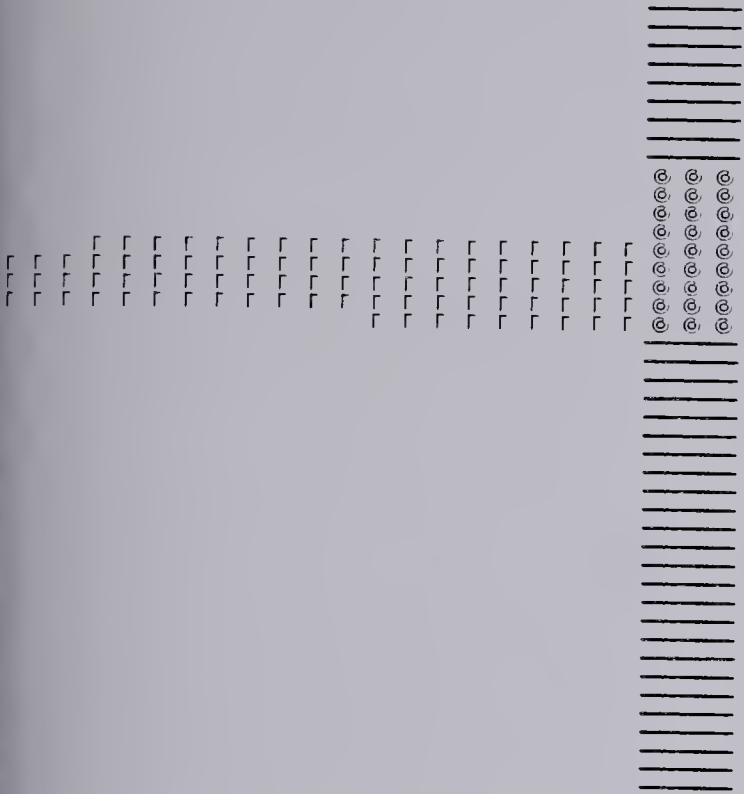
LINK 831 MAX FLOW 308 VEH/H M.M.E. O.O

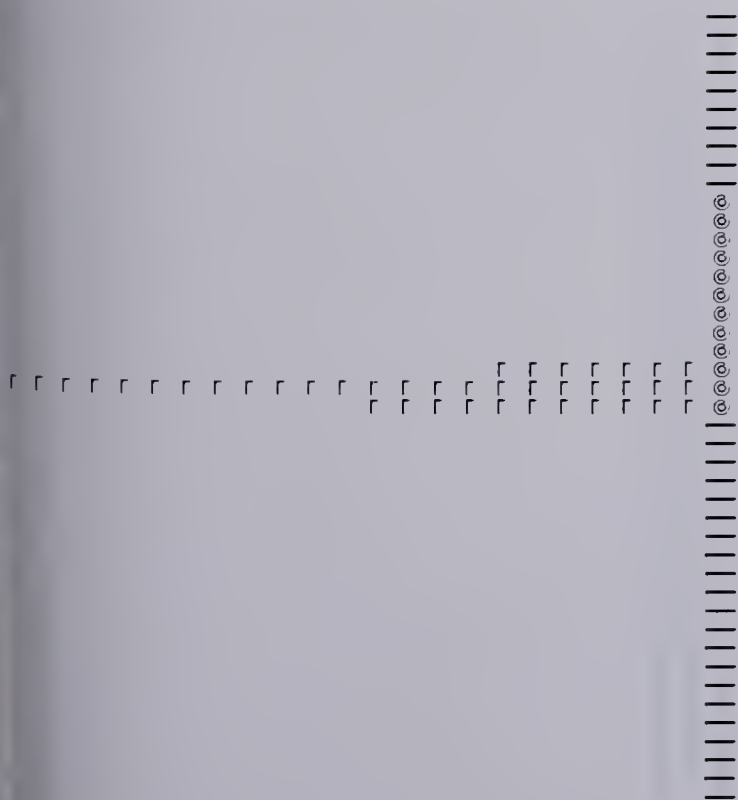




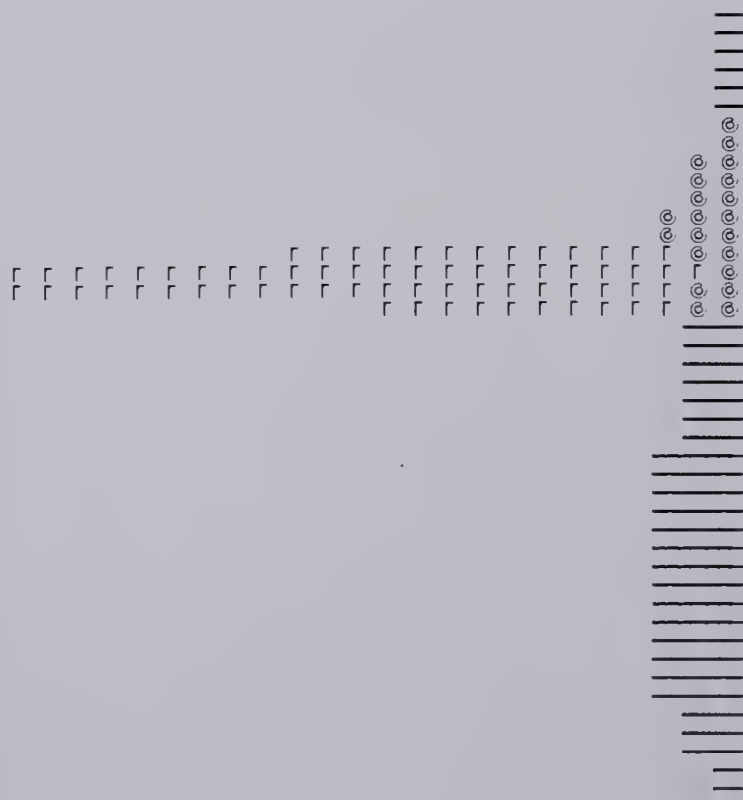






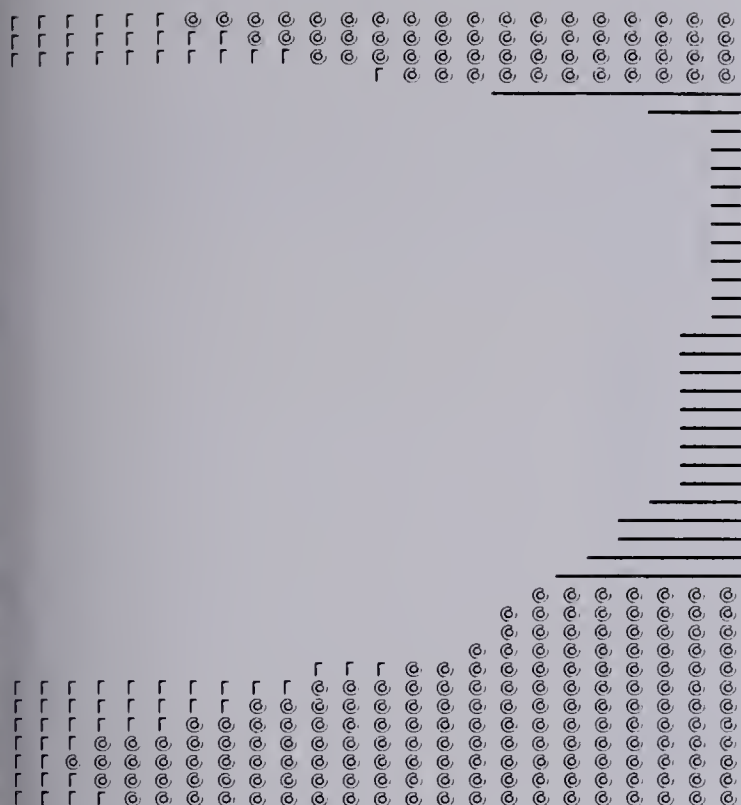


LINK 613 MAX FLOW 2015 VEH/H M.M.E. 0.32

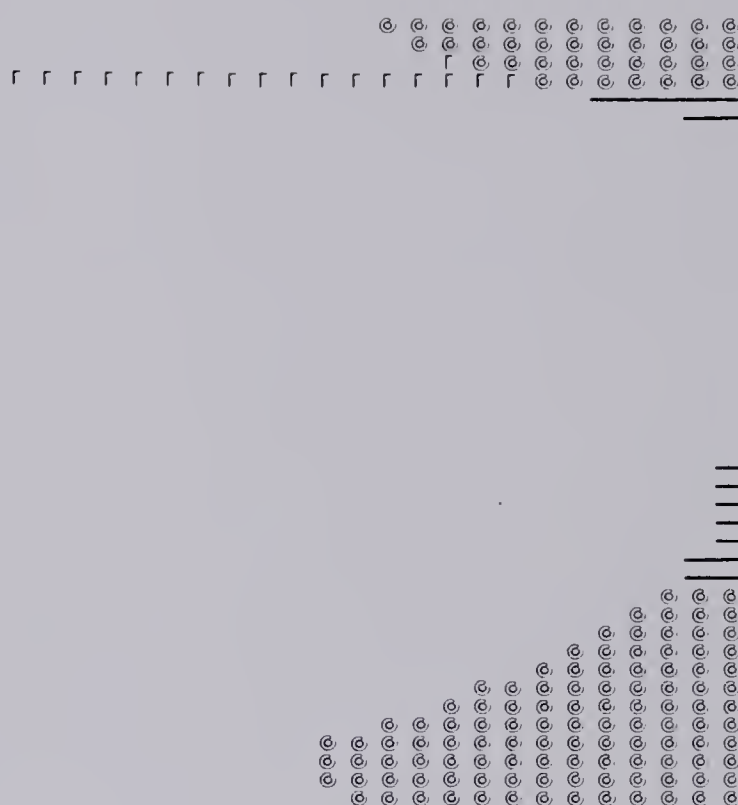


LINK 467 MAX FLOW 1240 VEH/H M.M.E. O.O

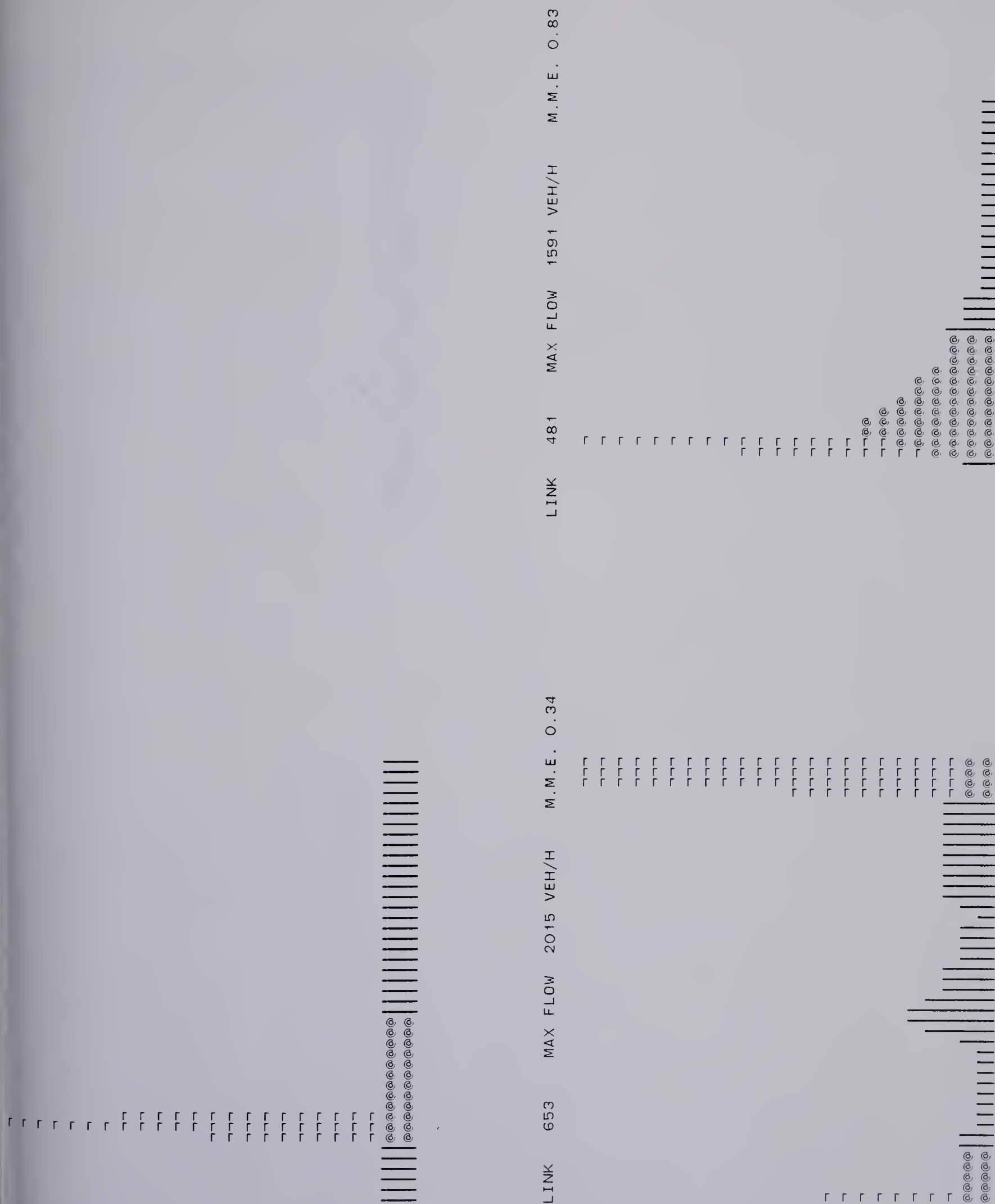
LINK 467 MAX FLOW 1240 VEH/H M.M.E. O.O



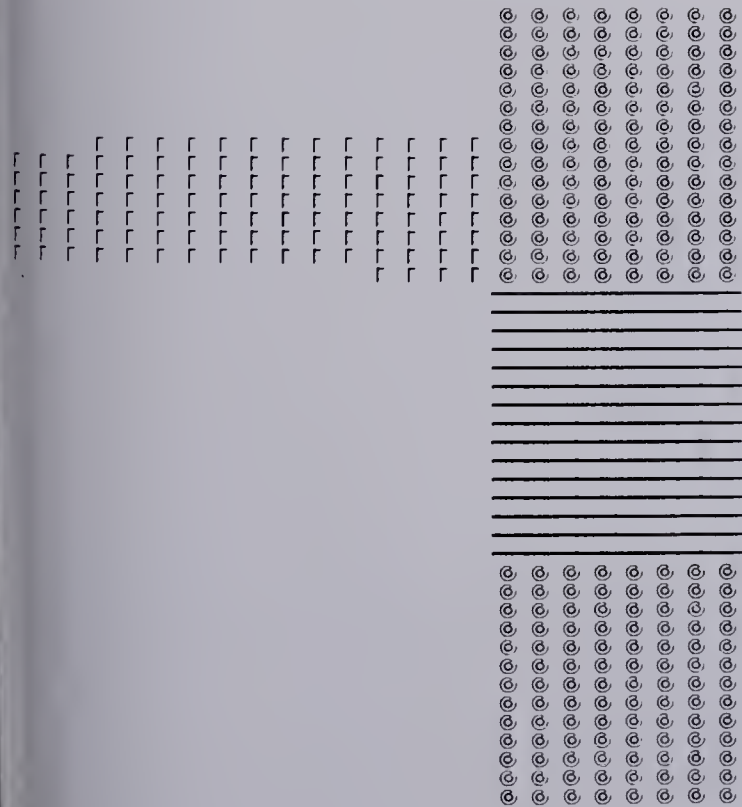
LINK 465 MAX FLOW 1395 VEH/H M.M.E. 1.06



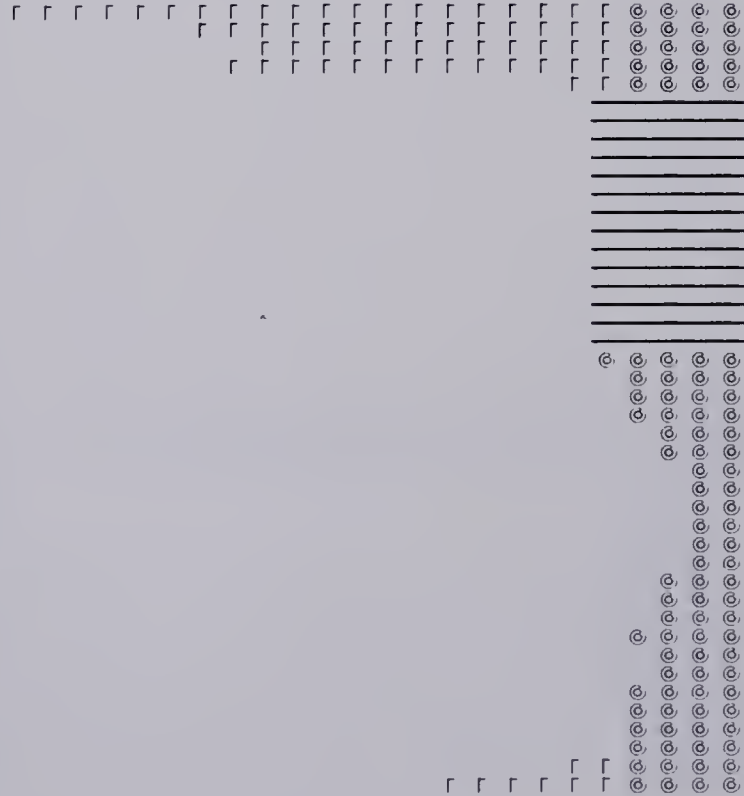
[illegible]



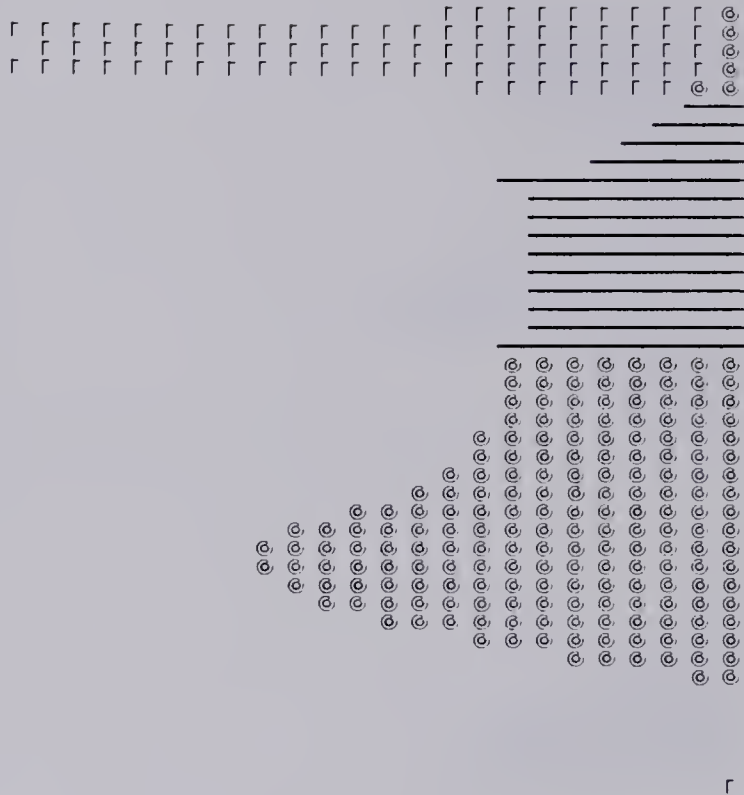


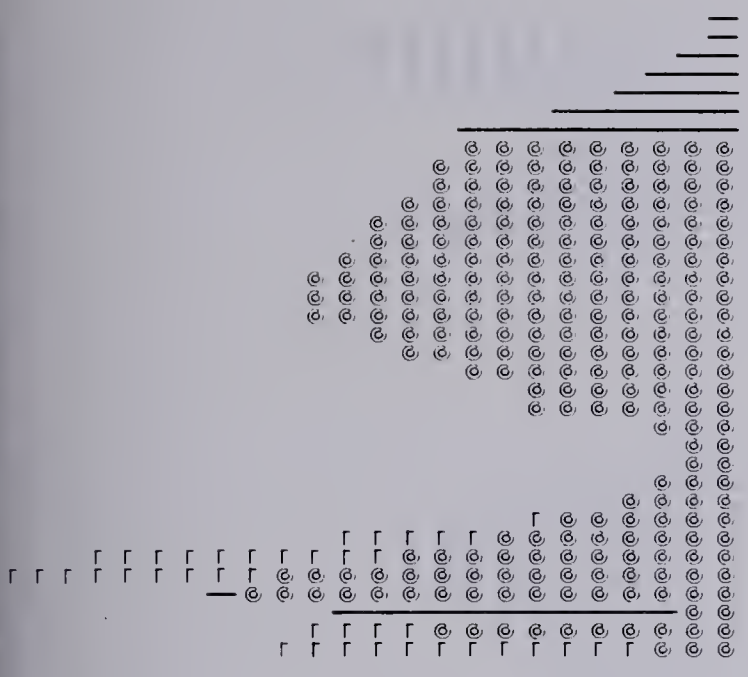


LINK 858 MAX FLOW 223 VEH/H M.M.E. 0.20

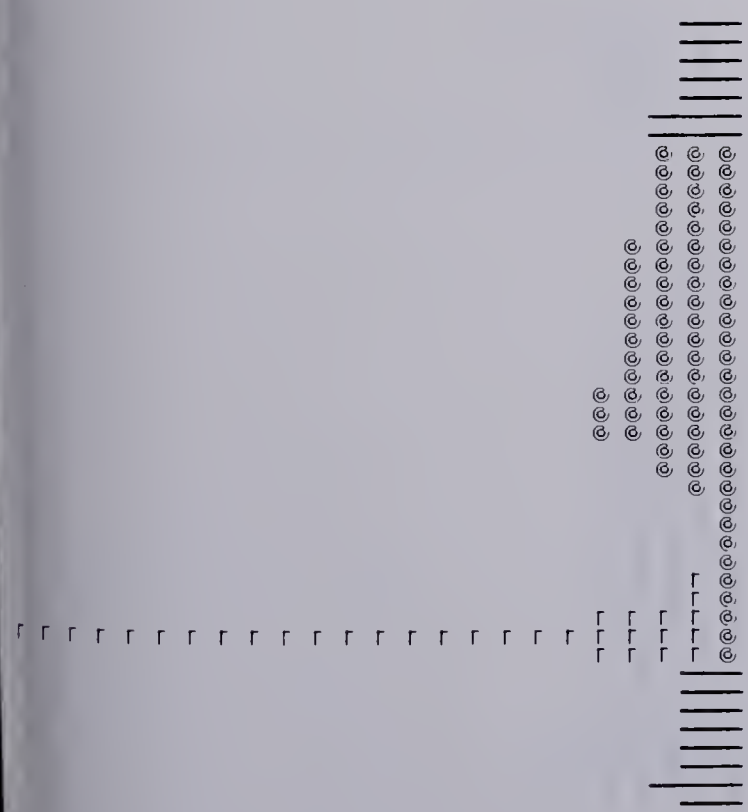
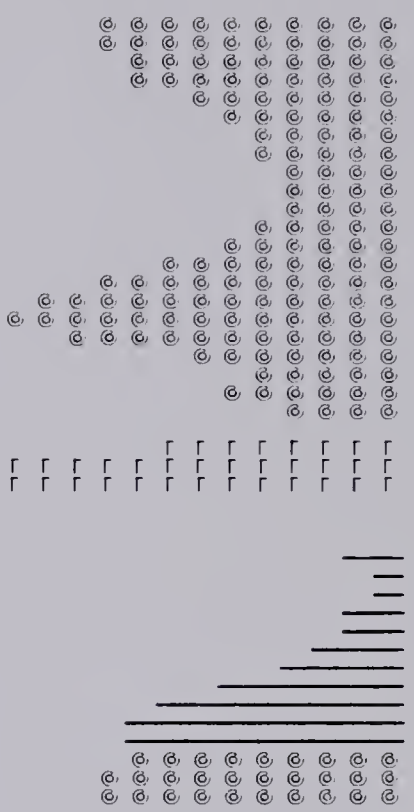


LINK 859 MAX FLOW 51 VEH/H M.M.E. 0.57

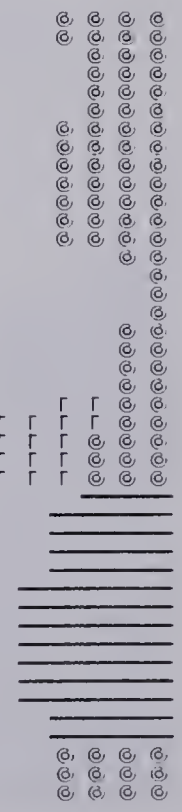


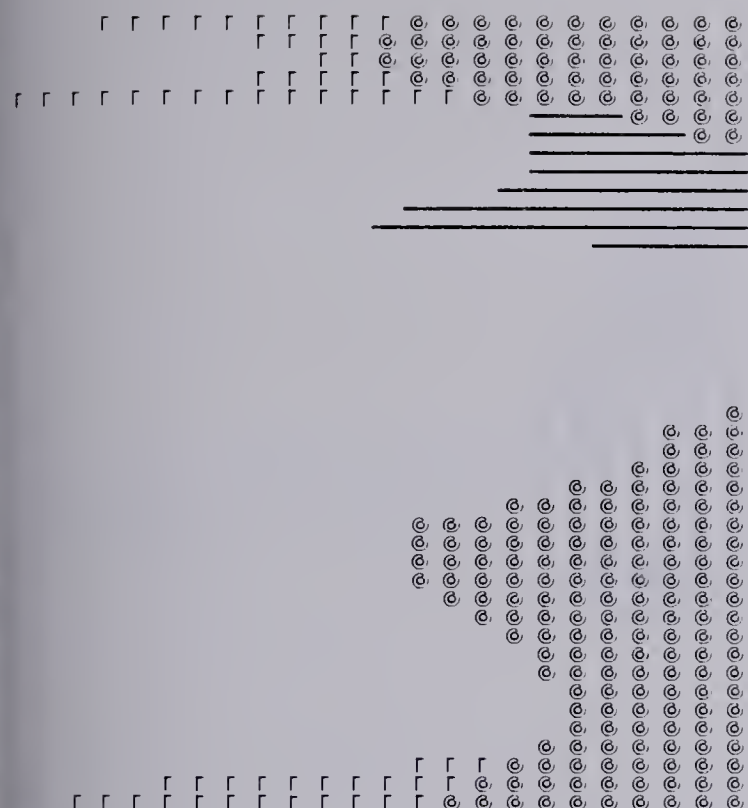


LINK 879 MAX FLOW 61 VEH/H M.M.E. 0.60

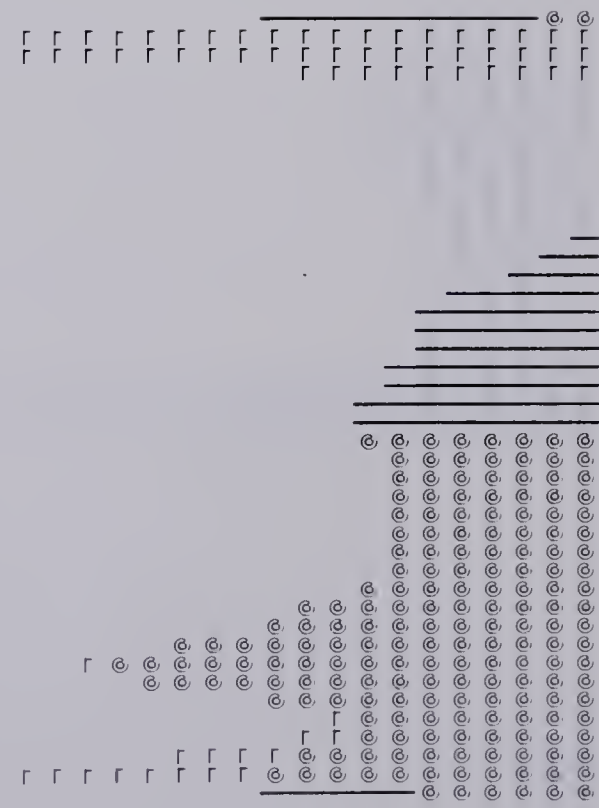
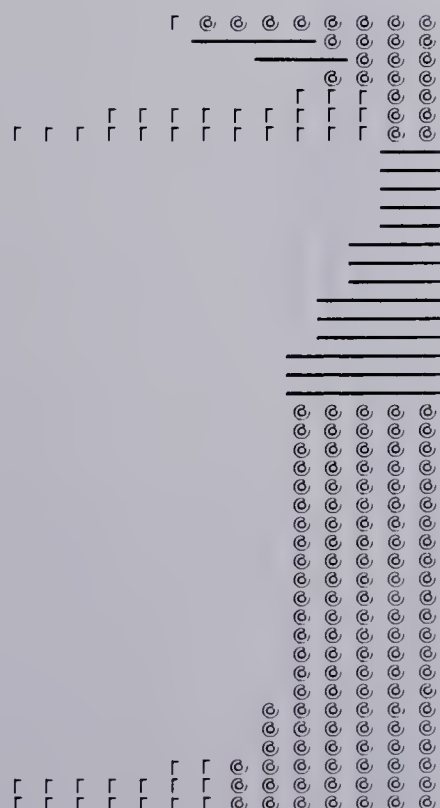


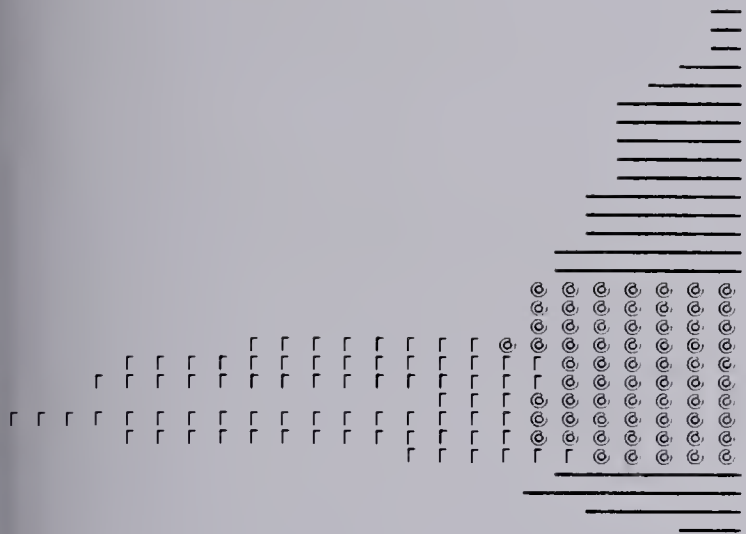
LINK 878 MAX FLOW 248 VEH/H M.M.E. 0.25



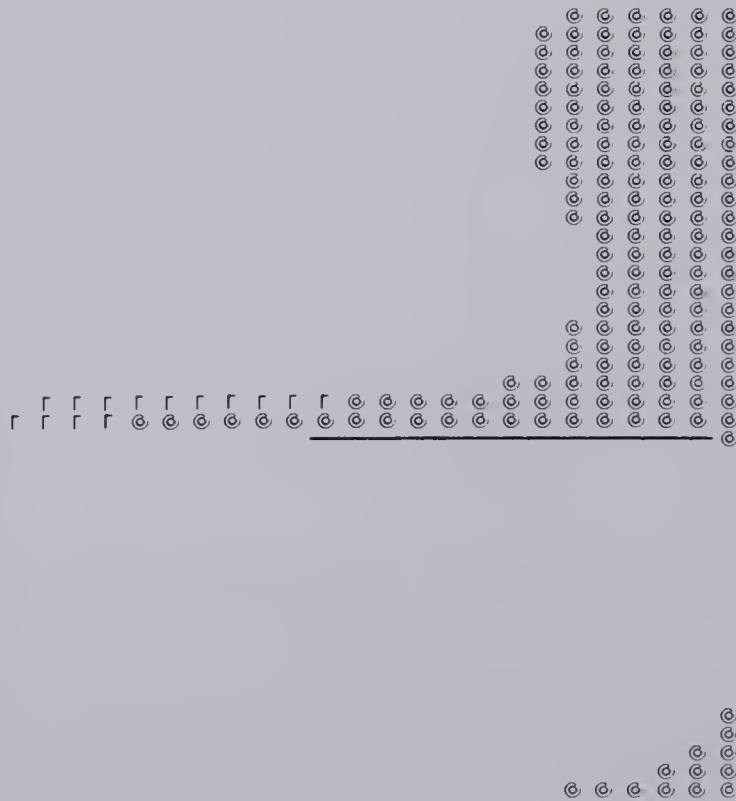


LINK 918 MAX FLOW 199 VEH/H M.M.E. 0.61





LINK 488 MAX FLOW 215 VEH/H M.M.E. 0.76



APPENDIX VII

TRANSYT Output for the AM Peak with No Delay Weighting for Auto
and a Bus Delay Weighting of 20

CBD WEST NETWORK - 108-121 STREET AM PEAK

TRANSYT/7

CARD NO.	CARD TYPE	CYCLE TIME	STEPS PER CYC.	STOP PERCY.	PERIOD LENGTH	LAG START	LAG END	WEIGHT+ EQUISAT	J.T./S	PRINT	CHECK	STEPS OR SECS	SCALE FLOWS	NO.OF COPIES
1	1	86	43	20	60	2	3	1	1	0	0	0	0	0

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE	95	85	81	87	89	91	46	48	83	93	61	76	65
2	2													0

HILLCLIMB STEP-SIZE LIST

CARD NO.	CARD TYPE	4	7	17	-1	7	17	1	-1	1	0	0	0	0
3	4													0

CARD NO.	CARD TYPE	UPPER LIMIT	1	2	3	4	5	6	7	8	9	10	11	12	13	14
4	5	4	62	83	96	99	0	0	0	0	0	0	0	0	0	0

REDUCTION OF STOP PENALTY FOR SHORT DELAYS

% STOP PENALTY FOR DELAYS (IN STEPS) OF

LINKS HAVING SHARED STOPLINES

CARD NO.	CARD TYPE	FIRST SET	SECOND SET	THIRD SET										
5	7	482	488	0	0	462	468	0	0	0	912	918	0	0
6	7	892	898	899	0	872	878	879	0	0	812	818	819	0
7	7	852	858	859	0	952	958	0	0	0	466	469	0	0

NODE CARDS: STAGE 1 STAGE 2 STAGE 3 STAGE 4 STAGE 5 STAGE 6 STAGE 7

CARD NO.	CARD TYPE	NO.	CHANGE	MIN	MIN	CHANGE	MIN	CHANGE	MIN	CHANGE	MIN	CHANGE	MIN	CHANGE	MIN	CHANGE	MIN
8	12	95	0	26	20	26	0	0	0	0	0	0	0	0	0	0	0
9	12	85	0	10	15	26	0	0	0	0	0	0	0	0	0	0	0
10	12	81	0	22	20	28	0	0	0	0	0	0	0	0	0	0	0
11	12	87	0	21	20	26	0	0	0	0	0	0	0	0	0	0	0
12	12	89	0	21	20	26	0	0	0	0	0	0	0	0	0	0	0
13	13	91	0	23	15	26	30	0	0	0	0	0	0	0	0	0	0
14	14	46	0	32	16	28	30	33	20	0	0	0	0	0	0	0	0
15	12	48	0	22	15	26	0	0	0	0	0	0	0	0	0	0	0
16	13	83	0	25	15	26	30	0	0	0	0	0	0	0	0	0	0
17	12	93	0	17	15	20	0	0	0	0	0	0	0	0	0	0	0
18	12	61	0	20	15	24	0	0	0	0	0	0	0	0	0	0	0
19	12	76	0	28	15	23	0	0	0	0	0	0	0	0	0	0	0
20	12	65	0	22	15	20	0	0	0	0	0	0	0	0	0	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST START	LAG	STAGE	END	LAG	STAGE	END	LAG	STAGE	END	LINK LENGTH	STOP PENALTY	SAT FLOW	DELAY WT.X100	DISPSN X100
21	31	951	95	2	5	1	0	0	0	0	0	0	0	710	1	4294	0	0
22	31	952	95	1	5	2	0	0	0	0	0	0	0	500	1	3472	0	0
23	31	953	95	2	10	1	0	0	0	0	0	0	0	500	1	1240	0	0
24	31	954	95	1	5	2	0	0	0	0	0	0	0	390	1	4340	0	0
25	31	958	0	0	0	0	0	0	0	0	0	0	0	500	1	2000	0	0
26	31	852	85	1	5	2	0	0	0	0	0	0	0	390	10	3472	0	0
27	31	854	85	1	5	2	0	0	0	0	0	0	0	243	1	4340	0	0
28	31	858	0	0	0	0	0	0	0	0	0	0	0	390	10	2000	0	0
29	31	859	0	0	0	0	0	0	0	0	0	0	0	390	10	2000	0	0
30	31	811	81	2	5	1	0	0	0	0	0	0	0	233	1	2387	0	0
31	31	812	81	1	5	2	0	0	0	0	0	0	0	243	1	3875	0	0
32	31	813	81	2	5	1	0	0	0	0	0	0	0	500	1	2170	0	0



CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY A		ENTRY B		ENTRY C		ENTRY D		
					LINK NO.	FLOW	TRAVEL TIME	LINK NO.	FLOW	TRAVEL TIME	LINK NO.	FLOW	TRAVEL TIME
88	32	951	248	0	0	0	838	248	45	0	0	0	0
89	32	952	1063	0	0	0	0	0	0	0	0	0	0
90	32	953	111	0	0	0	0	0	0	0	0	0	0
91	32	954	537	0	0	0	854	537	45	0	0	0	0
92	32	958	50	0	0	0	0	0	0	0	0	0	0
93	32	852	1421	0	953	111	952	1060	45	18	951	45	0

[illegible]

INITIAL SETTINGS

LINK NUMBER	NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
461	46	4	0	16	30	33	8.283	4.711	0.958	0.12 (99%)	11	46	37	66
462	48	2	0	30			11.856	5.284	0.124	0.21 (83%)	19	46	71	32
463	61	2	0	31			3.203	3.073	0.130	0.10 (80%)	9	46	37	60
464	65	2	0	29			6.129	3.695	0.125	0.11 (52%)	9	46	3	32
465	76	2	0	27			3.384	2.056	0.017	0.06 (99%)	5	46	37	66
466	81	2	0	27			4.359	1.890	0.734	0.07 (98%)	6	46	71	2
467	83	3	0	13	32		0.300	0.290	0.010	0.02 (43%)	1	46	37	0
468*	85	2	0	30			0.764	0.125	0.005	0.01 (72%)	19	46	71	32
469*	87	2	0	30			0.186	0.069	0.029	0.00 (99%)	6	46	71	2
481	89	2	0	29			2.211	1.344	0.026	0.03 (73%)	2	48	65	0
482	91	3	0	24	37		4.183	0.839	0.054	0.14 (54%)	15	48	5	60
483	93	2	0	33			0.927	0.905	0.022	0.03 (75%)	2	48	65	0
484	95	2	0	30			1.237	1.211	0.025	0.08 (38%)	7	48	5	60
488*							0.195	0.019	0.002	0.00 (40%)	15	48	5	60
612							4.042	0.866	0.646	0.05 (23%)	4	61	5	62
613							2.192	1.109	0.056	0.04 (81%)	3	61	67	0
614							3.047	0.508	0.026	0.04 (25%)	3	61	5	62
651							1.437	1.383	0.054	0.04 (75%)	4	65	63	0
652							3.438	1.123	0.060	0.06 (31%)	5	65	5	58
653							2.802	1.587	0.047	0.04 (80%)	4	65	63	0
654							0.608	0.595	0.012	0.04 (38%)	3	65	5	58
761							5.896	5.480	0.415	0.18 (82%)	16	76	59	0
762							3.981	1.555	0.426	0.06 (37%)	6	76	5	54
763							5.715	2.365	0.139	0.11 (74%)	11	76	59	0
764							2.212	0.899	0.047	0.05 (39%)	4	76	5	54
811							11.535	7.644	0.530	0.15 (96%)	13	81	59	0
812							18.297	6.637	0.496	0.25 (56%)	22	81	5	54
813							3.883	3.442	0.440	0.12 (83%)	10	81	59	0
814							4.739	1.259	0.021	0.06 (38%)	5	81	5	54
818*							0.851	0.186	0.011	0.01 (80%)	22	81	5	54
819*							0.160	0.034	0.004	0.00 (38%)	22	81	5	54
831							0.046	0.046	0.000	0.00 (57%)	0	83	31	64
832							1.840	1.667	0.172	0.08 (63%)	7	83	69	26
833							6.201	2.680	0.894	0.11 (85%)	9	83	31	64
834							3.226	1.106	0.062	0.04 (76%)	3	83	3	26

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	84	151.50	3.623	2.569	1.054	0.08 (91%)	7	83	69	2
837	268	1395	30	62.44	2.368	0.777	0.031	0.04 (52%)	3	83	31	0
838	347	2790	45	170.03	6.447	2.107	0.089	0.07 (77%)	6	83	3	26
852	1421	3472S	65	554.19	15.551	2.944	0.292	0.17 (42%)	15	85	5	60
854	549	4340	19	133.41	4.140	0.793	0.012	0.05 (33%)	4	85	5	60
858*	36	852L	65	14.04	1.140	0.076	0.007	0.01 (51%)	15	85	5	60
859*	14	852L	65	5.46	0.240	0.042	0.003	0.00 (60%)	15	85	5	60
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	65	0
872	1245	3348S	59	303.78	11.685	2.797	0.209	0.13 (39%)	13	87	5	60
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	65	0
874	613	3379	28	149.57	5.159	1.392	0.027	0.07 (44%)	7	87	5	60
878*	36	872L	59	8.78	0.784	0.133	0.006	0.01 (69%)	13	87	5	60
879*	14	872L	59	3.42	0.177	0.053	0.002	0.00 (60%)	13	87	5	60
891	173	1085	57	40.65	2.990	1.785	0.189	0.04 (89%)	4	89	63	0
892	1211	3364S	60	295.48	12.529	3.875	0.212	0.18 (53%)	16	89	5	58
893	106	1085	35	53.00	0.752	0.705	0.047	0.02 (75%)	2	89	63	0
894	704	2945	38	85.89	2.667	0.461	0.058	0.04 (22%)	5	89	5	58
898*	36	892L	60	8.78	0.800	0.138	0.006	0.01 (66%)	16	89	5	58
899*	14	892L	60	3.42	0.157	0.032	0.002	0.00 (40%)	16	89	5	58
912	1328	3255S	79	162.02	9.565	4.217	0.719	0.15 (40%)	15	91	3	48
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	53	74
914	838	3100	42	204.47	6.613	1.428	0.073	0.08 (33%)	7	91	79	48
918*	50	912L	79	6.10	0.382	0.137	0.027	0.00 (31%)	15	91	3	48
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	71	0
932	671	1395	67	328.79	10.729	1.002	0.333	0.09 (47%)	8	93	5	66
933	72	1085	36	16.92	1.011	0.539	0.049	0.02 (79%)	1	93	71	0
934	412	3643	16	50.26	1.487	0.224	0.007	0.01 (13%)	1	93	5	66
951	248	4294	23	176.08	4.899	0.969	0.016	0.04 (62%)	4	95	65	0
952	1063	3472S	49	531.50	2.237	2.123	0.114	0.14 (46%)	13	95	5	60
953	111	1240	45	55.50	1.005	0.912	0.093	0.03 (85%)	2	95	70	0
954	537	4340	19	209.43	5.604	0.939	0.011	0.06 (38%)	5	95	5	60
958	50	952L	49	25.00	0.105	0.100	0.005	0.01 (46%)	13	95	5	60

TIME SINCE START OF RUN	USE OF SUBROUTINE SUBPT NO. OF NO. OF ENTRIES LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
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aaaa	1	83	7212.18	251.315	103.758	10.811	5.67	28.70
			78.25	5.837	1.044	0.106	0.12	13.41 BUSES
			7133.92	245.478	102.714	10.704	5.55	29.06 OTHER

CPU TIME USED SO FAR IS 0.72 SECS

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7

[illegible]



REC'D JUN 18, 1964

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17

46
48
61
65
76
81
83
85
87
89
91
93
95

4 2 2 2 2 2 3 2 2 2 3 2 2

(3) 1 1 2 (3)

33

माता

27

1029

7212.18

229. 190

81.633

10.811

4.95

207.32

31.47

14.44 BUSES

BUSES

31.88 OTHER

OTHER

CPU TIME USED SO FAR IS 4.76 SECS

INTERMEDIATE SETTINGS - STEP SIZES, SO FAR :- 7 17 -1

46	4	0	16	30	33
48	2	39	26		
61	2	0	31		
65	2	14	4		
76	2	9	34		
81	2	14	41		
83	3	0	13	32	
85	2	0	30		
87	2	21	8		
89	2	2	32		
91	3	7	31	1	
93	2	0	31		
95	2	36	18		

Saaaa

1589

7212.18

229.387

81.576

11.064

4.44

199.00

31.44

14.43 BUSES

31.85 OTHER

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CPU TIME USED SO FAR IS 7.65 SECS

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INTERMEDIATE SETTINGS - STEP SIZES, SO FAR :- 7 17 -1 7

46	4	36	9	23	26
48	2	32	19		
61	2	0	31		
65	2	14	4		
76	2	9	34		
81	2	14	41		
83	3	0	13	32	
85	2	0	30		
87	2	21	8		
89	2	2	32		
91	3	7	31	1	
93	2	0	31		
95	2	36	18		

zaaaa	29	1110	7212.18	224.427	76.616	11.064	4.30	191.18	32.14
			78.25	5.422	0.630	0.105	0.09	16.56	14.43 BUSES
			7133.92	219.005	75.987	10.959	4.20	174.61	32.57 OTHER

CPU TIME USED SO FAR IS 9.64 SECS

17

26

[illegible]

11.52 SECS


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CPU TIME USED SO FAR IS      13.63 SECS

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[illegible]

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17 -1 7 17 1 -1

46	4	35	8	22	25
48	2	31	18		
61	2	3	34		
65	2	15	5		
76	2	8	34		
81	2	14	41		
83	3	42	12	31	
85	2	0	30		
87	2	22	9		
89	2	2	32		
91	3	7	31	1	
93	2	42	30		
95	2	33	10		

9a7a7a

	9aaa	40	1238	7212.18	225.430	77.266	11.417	3.89	185.97	31.99
BUSES				78.25	5.400	0.608	0.105	0.08	15.94	14.49
OTHER				7133.92	220.030	76.658	11.312	3.81	170.03	32.42

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CPU TIME USED SO FAR IS      15.87 SECS

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LINK NUMBER	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
46	4	34	7	21	24				1.773	0.958	0.11 (91%)	10	46	19	48
48	2	30	17						1.225	0.124	0.12 (48%)	13	46	53	14
61	2	3	34						3.073	0.130	0.10 (80%)	9	46	19	42
65	2	15	5						3.467	0.125	0.12 (58%)	12	46	71	14
76	2	8	34						0.328	0.017	0.03 (55%)	3	46	19	48
81	2	14	41						1.583	0.734	0.05 (78%)	5	46	53	70
83	3	42	12	31					0.290	0.010	0.02 (43%)	1	46	19	68
85	2	1	31						0.075	0.005	0.00 (37%)	13	46	53	14
87	2	22	9						0.068	0.029	0.00 (76%)	5	46	53	70
89	2	2	32						0.442	0.026	0.02 (45%)	2	48	39	60
91	3	6	30	0					0.374	0.054	0.02 (9%)	3	48	65	34
93	2	42	30						0.905	0.022	0.03 (75%)	2	48	65	60
95	2	32	9						1.237	0.025	0.08 (38%)	7	48	65	34
461	447	1550	83		104.60	5.346	1.773	0.958	0.003	0.002	0.00 (6%)	3	48	65	34
462	925	3410S	50		225.70	7.798	1.225	0.124	0.003	0.002	0.03 (15%)	4	61	11	68
463	439	3100	51		103.16	3.203	3.073	0.130	0.515	0.646	0.04 (80%)	3	61	73	6
464	757	4340	50		92.35	5.900	3.467	0.125	1.121	0.056	0.04 (31%)	4	61	11	68
465	224	2790	23		52.42	1.655	0.328	0.017	0.703	0.026	0.05 (87%)	4	65	15	30
466	249	1550S	80		60.76	4.052	1.583	0.734	1.773	0.169	0.02 (13%)	3	65	35	10
467	131	1240	18		30.78	0.300	0.290	0.010	0.262	0.042	0.05 (88%)	4	65	15	30
468*	36	462L	50		8.78	0.715	0.075	0.005	1.513	0.145	0.03 (28%)	2	65	35	10
469*	10	466L	80		2.44	0.185	0.068	0.029	0.326	0.009	0.18 (80%)	16	76	73	16
481	142	2015	28		33.65	1.309	0.442	0.026	1.092	0.513	0.06 (35%)	6	76	21	68
482	944	4030S	37		115.17	3.718	0.374	0.054	3.656	0.113	0.12 (81%)	11	76	73	16
483	132	2015	26		31.02	0.927	0.905	0.022	0.780	0.052	0.04 (35%)	4	81	1	28
484	735	4154	27		89.67	1.237	1.211	0.025	1.222	0.496	0.10 (23%)	12	81	33	82
488*	40	482L	37		4.88	0.180	0.003	0.002	3.442	0.440	0.12 (83%)	6	81	33	82
612	726	1395	77		88.57	3.692	0.515	0.646	1.688	0.021	0.07 (47%)	12	81	33	82
613	175	2015	37		41.13	2.205	1.121	0.056	0.074	0.011	0.00 (37%)	12	81	33	82
614	512	2759	28		124.93	3.243	0.703	0.026	0.024	0.004	0.00 (26%)	0	83	29	62
651	207	2015	55		103.50	1.943	1.773	0.169	1.667	0.172	0.08 (63%)	7	83	67	24
652	647	2682	33		78.93	2.559	0.262	0.042	2.963	0.894	0.10 (84%)	9	83	29	62
653	197	2015	53		46.69	2.825	1.513	0.145	1.138	0.062	0.04 (77%)	3	83	1	24
654	336	2666	17		40.99	0.335	0.326	0.009							
761	806	3519	66		143.47	5.418	5.106	0.313							
762	574	1395	74		70.03	3.605	1.092	0.513							
763	549	3255	48		128.47	6.981	3.656	0.113							
764	415	2046	36		50.63	2.098	0.780	0.052							
811	577	2387	74		134.44	5.113	1.222	0.530							
812	1608	3875S	74		390.74	13.202	1.542	0.496							
813	504	2170	71		252.00	3.883	3.442	0.440							
814	567	3875	25		138.35	5.168	1.688	0.021							
818*	36	812L	74		8.75	0.740	0.074	0.011							
819*	14	812L	74		3.40	0.150	0.024	0.004							
831	11	1240	2		5.50	0.046	0.046	0.000							
832	440	1550	55		220.00	1.840	1.667	0.172							
833	451	1395	82		105.08	6.484	2.963	0.894							
834	168	1550	39		82.32	3.258	1.138	0.062							

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	84	151.50	3.623	2.569	1.054	0.08 (91%)	7	83	67	0
837	268	1395	30	62.44	1.916	0.324	0.031	0.03 (45%)	3	83	29	84
838	347	2790	45	170.03	6.640	2.299	0.089	0.08 (80%)	7	83	1	24
852	1421	3472S	65	554.19	13.323	0.715	0.292	0.04 (11%)	5	85	7	62
854	549	4340	19	133.41	3.969	0.622	0.012	0.04 (24%)	4	85	7	62
858*	36	852L	65	14.04	1.147	0.083	0.007	0.01 (50%)	5	85	7	62
859*	14	852L	65	5.46	0.206	0.008	0.003	0.00 (9%)	5	85	7	62
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	23	44
872	1245	3348S	59	303.78	10.055	1.167	0.209	0.06 (17%)	6	87	49	18
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	23	44
874	613	3379	28	149.57	4.557	0.791	0.027	0.08 (45%)	7	87	49	18
878*	36	872L	59	8.78	0.731	0.081	0.006	0.00 (45%)	6	87	49	18
879*	14	872L	59	3.42	0.146	0.022	0.002	0.00 (23%)	6	87	49	18
891	173	1085	62	40.65	2.620	1.348	0.255	0.03 (69%)	3	89	69	4
892	1211	3364S	58	295.48	11.303	2.673	0.187	0.22 (64%)	21	89	9	64
893	106	1085	38	53.00	0.811	0.752	0.059	0.02 (78%)	2	89	69	4
894	704	2945	37	85.89	2.516	0.315	0.053	0.01 (7%)	1	89	9	64
898*	36	892L	58	8.78	0.724	0.062	0.006	0.01 (52%)	21	89	9	64
899*	14	892L	58	3.42	0.152	0.028	0.002	0.00 (53%)	21	89	9	64
912	1328	3255S	79	162.02	6.981	1.632	0.719	0.07 (19%)	7	91	15	60
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	65	0
914	838	3100	42	204.47	5.614	0.429	0.073	0.03 (14%)	4	91	5	60
918*	50	912L	79	6.10	0.333	0.088	0.027	0.00 (21%)	7	91	15	60
931	122	1085	48	61.00	1.050	0.938	0.113	0.03 (82%)	2	93	65	84
932	671	1395	71	328.79	11.127	1.292	0.441	0.10 (53%)	9	93	3	60
933	72	1085	29	16.92	0.991	0.540	0.028	0.02 (87%)	2	93	65	84
934	412	3643	17	50.26	1.875	0.611	0.008	0.04 (32%)	3	93	3	60
951	248	4294	12	176.08	4.897	0.980	0.004	0.03 (50%)	3	95	23	64
952	1063	3472S	77	531.50	6.656	6.062	0.594	0.24 (80%)	22	95	69	18
953	111	1240	21	55.50	0.469	0.455	0.014	0.02 (59%)	2	95	28	64
954	537	4340	30	209.43	7.014	2.329	0.031	0.10 (66%)	9	95	69	18
958	50	952L	77	25.00	0.313	0.285	0.028	0.01 (80%)	22	95	69	18
TIME SINCE START OF RUN												
TOTAL				TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)		
Kaaaa				7212.18	224.889	76.725	11.417	3.84	184.53	32.07		
				78.25	5.409	0.617	0.105	0.08	16.06	14.47	BUSES	
				7133.92	219.480	76.108	11.312	3.76	168.47	32.50	OTHER	

CPU TIME USED SO FAR IS 17.90 SECS

APPENDIX VIII

TRANSYT Output for the AM Peak with One Bus Link Only
and a Bus Delay Weighting of 20

CBD WEST NETWORK - 108-121 STREET AM PEAK

TRANSYT/7

CARD NO.	CARD TYPE	CYCLE TIME	STEPS PER CYC.	STOP PERCY.	PERIOD LENGTH	LAG START	LAG END	WEIGHT+ EQUISAT	J.T./S PRINT	MARKERS CHECK	STEPS OR SECS	SCALE FLOWS	NO.OF COPIES
1	1	86	43	20	60	2	3	1	1	0	0	0	0

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE	85	81	87	89	91	46	48	83	93	61	76	65	0
2	2	95												

HILLCLIMB STEP-SIZE LIST

CARD NO.	CARD TYPE	7	17	7	17	1	-1	1	0	0	0	0	0	0
3	4													

REDUCTION OF STOP PENALTY FOR SHORT DELAYS (IN STEPS) OF

CARD NO.	CARD TYPE	UPPER LIMIT	1	2	3	4	5	6	7	8	9	10	11	12	13	14
4	5	4	62	83	96	99	0	0	0	0	0	0	0	0	0	0

LINKS HAVING SHARED STOPLINES

CARD NO.	CARD TYPE	FIRST SET	SECOND SET	THIRD SET
5	7	482	488	0
6	7	892	898	0
7	7	852	858	0

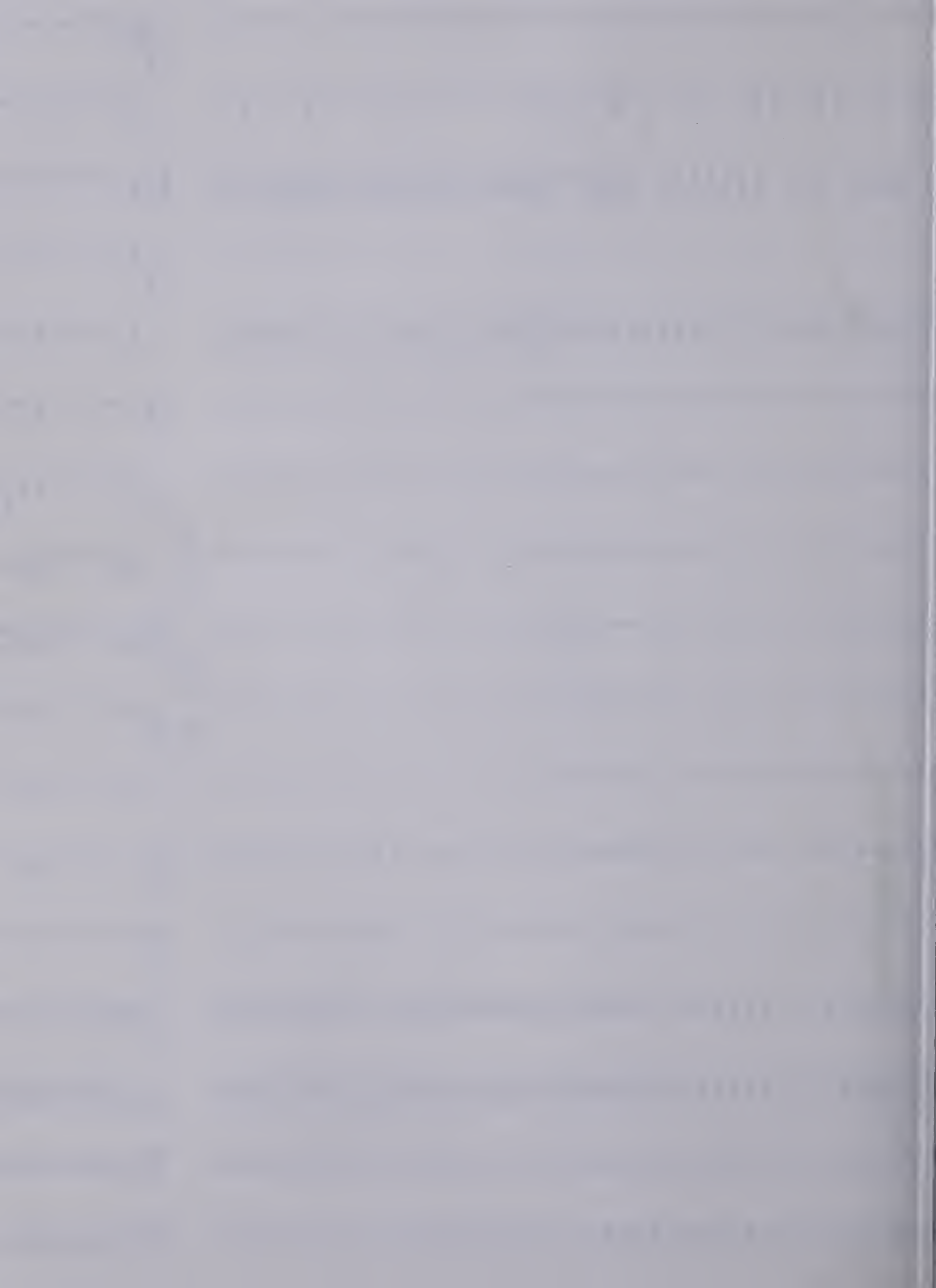
CARD NO.	CARD TYPE	NO.	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
8	12	95	0	26	0	0	0	0	0
9	12	85	0	10	0	0	0	0	0
10	12	81	0	22	0	0	0	0	0
11	12	87	0	21	0	0	0	0	0
12	12	89	0	21	0	0	0	0	0
13	13	91	0	23	0	0	0	0	0
14	14	46	0	32	0	20	0	0	0
15	12	48	0	22	0	0	0	0	0
16	13	83	0	25	0	0	0	0	0
17	12	93	0	17	0	0	0	0	0
18	12	61	0	20	0	0	0	0	0
19	12	76	0	28	0	0	0	0	0
20	12	65	0	22	0	0	0	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN	SECOND GREEN	END	LAG	STAGE	MIN	CHANGE	LAG	STAGE	MIN	CHANGE	LINK LENGTH	STOP PENALTY	SAT FLOW	DELAY WT.X100	DISPSN X100
21	31	951	95	2	5	1	0	0	0	0	0	0	0	0	710	1	4294	0	0
22	31	952	95	1	5	2	0	0	0	0	0	0	0	0	500	1	3472	500	0
23	31	953	95	2	10	1	0	0	0	0	0	0	0	0	500	1	1240	0	0
24	31	954	95	1	5	2	0	0	0	0	0	0	0	0	390	1	4340	0	0
25	31	958	0	0	0	0	0	0	0	0	0	0	0	0	500	1	0	2000	0
26	31	852	85	1	5	2	0	0	0	0	0	0	0	0	390	10	3472	500	0
27	31	854	85	1	5	2	0	0	0	0	0	0	0	0	243	1	4340	0	0
28	31	858	0	0	0	0	0	0	0	0	0	0	0	0	390	10	0	2000	0
29	31	811	81	2	5	1	0	0	0	0	0	0	0	0	233	1	2387	0	0
30	31	812	81	1	5	2	0	0	0	0	0	0	0	0	243	1	3875	500	0
31	31	813	81	2	5	1	0	0	0	0	0	0	0	0	500	1	2170	0	0
32	31	814	81	1	5	2	0	0	0	0	0	0	0	0	244	1	3875	0	0



CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY A LINK NO. FLOW TRAVEL TIME	LINK CARDS: ENTRY B LINK NO. FLOW TRAVEL TIME	ENTRY C LINK NO. FLOW TRAVEL TIME	ENTRY D LINK NO. FLOW TRAVEL TIME
83	32	951	248	0	0	838	0	0
84	32	952	1105	0	0	0	0	0
85	32	953	111	0	0	0	0	0
86	32	954	537	0	0	854	0	0
87	32	958	36	0	0	0	0	0
88	32	852	1463	0	953	952	951	0
89	32	854	549	0	811	814	813	0
90	32	858	36	0	0	958	0	0
91	32	811	577	0	836	0	838	0
92	32	812	1650	0	0	852	0	0
93	32	813	504	0	0	0	0	0



INITIAL SETTINGS

NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
46	4	0	16	30	33				461	447	1550	83	104.60	8.284	4.711	0.958	0.12 (99%)	11	46	37	66
48	2	0	30						462	937	3410S	51	228.63	12.038	5.377	0.129	0.22 (84%)	19	46	71	32
61	2	0	31						463	439	3100	51	103.16	3.203	3.073	0.130	0.10 (80%)	9	46	37	60
65	2	0	29						464	757	4340	50	92.35	6.129	3.695	0.125	0.11 (52%)	9	46	3	32
76	2	0	27						465	224	2790	23	52.42	3.384	2.056	0.017	0.06 (99%)	5	46	37	66
81	2	0	27						466	279	1550	86	68.08	5.331	2.156	1.231	0.08 (99%)	7	46	71	2
83	3	0	13	32					467	131	1240	18	30.78	0.300	0.290	0.010	0.02 (43%)	1	46	37	0
85	2	0	30						468*	36	462L	51	8.78	0.757	0.118	0.005	0.01 (70%)	19	46	71	32
87	2	0	30						481	142	2015	28	33.65	2.211	1.344	0.026	0.03 (73%)	2	48	65	0
89	2	0	29						482	944	4030S	37	115.17	4.163	0.819	0.054	0.14 (53%)	15	48	5	60
91	3	0	24	37					483	132	2015	26	31.02	0.927	0.905	0.022	0.03 (75%)	2	48	65	0
93	2	0	33						484	735	4154	27	89.67	1.237	1.211	0.025	0.08 (38%)	7	48	5	60
95	2	0	30						488*	40	482L	37	4.88	0.193	0.016	0.002	0.00 (35%)	15	48	5	60
									612	726	1395	77	88.57	4.041	0.865	0.646	0.05 (23%)	4	61	5	62
									613	175	2015	37	41.13	2.190	1.106	0.056	0.04 (81%)	3	61	67	0
									614	512	2759	28	124.93	3.047	0.508	0.026	0.04 (25%)	3	61	5	62
									651	207	2015	37	103.50	1.437	1.383	0.054	0.04 (75%)	4	65	63	0
									652	647	2682	38	78.93	3.439	1.124	0.060	0.06 (31%)	5	65	5	58
									653	197	2015	35	46.69	2.802	1.588	0.047	0.04 (80%)	4	65	63	0
									654	336	2666	20	40.99	0.608	0.595	0.012	0.04 (38%)	3	65	5	58
									761	806	3519	70	143.47	5.896	5.480	0.415	0.18 (82%)	16	76	59	0
									762	574	1395	71	70.03	3.985	1.559	0.426	0.06 (37%)	6	76	5	54
									763	549	3255	52	128.47	5.736	2.386	0.139	0.11 (75%)	11	76	59	0
									764	415	2046	35	50.63	2.212	0.899	0.047	0.05 (39%)	4	76	5	54
									811	577	2387	74	134.44	11.535	7.644	0.530	0.15 (96%)	13	81	59	0
									812	1650	3875S	75	400.95	18.875	6.877	0.543	0.26 (56%)	23	81	5	54
									813	504	2170	71	252.00	3.883	3.442	0.440	0.12 (83%)	10	81	59	0
									814	567	3875	25	138.35	4.739	1.259	0.021	0.06 (38%)	5	81	5	54
									818*	36	812L	75	8.75	0.855	0.189	0.012	0.01 (82%)	23	81	5	54
									831	11	1240	2	5.50	0.046	0.046	0.000	0.00 (57%)	0	83	31	64
									832	440	1550	55	220.00	1.840	1.667	0.172	0.08 (63%)	7	83	69	26
									833	451	1395	82	105.08	6.202	2.681	0.894	0.11 (85%)	9	83	31	64
									834	168	1550	39	82.32	3.222	1.103	0.062	0.04 (76%)	3	83	3	26
									836	303	1550	84	151.50	3.623	2.569	1.054	0.08 (91%)	7	83	69	2
									837	268	1395	30	62.44	2.369	0.777	0.031	0.04 (52%)	3	83	31	0

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	GREEN PERIOD END (SEC)
838	347	2790	45	170.03	6.448	2.108	0.089	0.07 (77%)	6	83	3	26
852	1463	3472S	66	570.57	16.074	3.076	0.318	0.17 (42%)	16	85	5	60
854	549	4340	19	133.41	4.140	0.793	0.012	0.05 (33%)	4	85	5	60
858*	36	852L	66	14.04	1.141	0.077	0.008	0.01 (51%)	16	85	5	60
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	65	0
872	1287	3348S	61	314.03	12.146	2.946	0.228	0.14 (39%)	14	87	5	60
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	65	0
874	613	3379	28	149.57	5.159	1.392	0.027	0.07 (44%)	7	87	5	60
878*	36	872L	61	8.78	0.786	0.135	0.006	0.01 (69%)	14	87	5	60
891	173	1085	57	40.65	2.991	1.785	0.189	0.04 (89%)	4	89	63	0
892	1253	3364S	61	305.73	13.029	4.062	0.232	0.18 (53%)	16	89	5	58
893	106	1085	35	53.00	0.752	0.705	0.047	0.02 (75%)	2	89	63	0
894	704	2945	38	85.89	2.667	0.461	0.058	0.04 (22%)	5	89	5	58
898*	36	892L	61	8.78	0.804	0.141	0.007	0.01 (67%)	16	89	5	58
912	1370	3255S	81	167.14	10.005	4.411	0.819	0.16 (41%)	15	91	3	48
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	53	74
914	838	3100	42	204.47	6.613	1.428	0.073	0.08 (33%)	7	91	79	48
918*	36	912L	81	4.39	0.248	0.069	0.022	0.00 (24%)	15	91	3	48
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	71	0
932	671	1395	67	328.79	10.730	1.003	0.333	0.09 (47%)	8	93	5	66
933	72	1085	36	16.92	0.999	0.527	0.049	0.02 (77%)	1	93	71	0
934	412	3643	16	50.26	1.487	0.224	0.007	0.01 (13%)	1	93	5	66
951	248	4294	23	176.08	4.899	0.970	0.016	0.04 (62%)	4	95	65	0
952	1105	3472S	50	552.50	2.358	2.233	0.124	0.14 (47%)	13	95	5	60
953	111	1240	45	55.50	1.005	0.912	0.093	0.03 (85%)	2	95	70	0
954	537	4340	19	209.43	5.604	0.939	0.011	0.06 (38%)	5	95	5	60
958	36	952L	50	18.00	0.077	0.073	0.004	0.00 (47%)	13	95	5	60
TIME				TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	PERFORMANCE	SPEED		
SINCE				DISTANCE	TIME	UNIFORM	RANDOM	UNIFORM	INDEX	(KM/H)		
START				TRAVELLED	SPENT	DELAY	DELAY	STOPS				
OF RUN				(VEH KM/H)	(VEH H/H)	(VEH H/H)	(VEH H/H)	(VEH/SEC)				
				7268.79	254.003	104.796	11.488	5.73	439.11	28.62		
				58.41	4.784	0.744	0.061	0.09	17.84	12.21	BUSES	
				7210.38	249.219	104.051	11.427	5.65	421.27	28.93	OTHER	

CPU TIME USED SO FAR IS 0.65 SECS

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7

46	4	21	37	8	11
48	2	14	1		
61	2	36	24		
65	2	7	36		
76	2	0	27		
81	2	7	34		
83	3	36	6	25	
85	2	36	23		
87	2	21	8		
89	2	36	22		
91	3	36	17	30	
93	2	36	26		
95	2	36	23		

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Caaaa	39	1275	7268.79	229.832	80.625	11.488	5.24	319.15	31.63
			58.41	4.531	0.492	0.061	0.07	12.48	12.89 BUSES
			7210.38	225.301	80.133	11.427	5.17	306.68	32.00 OTHER
CPU TIME USED	S0	FAR IS	3.01 SECS						

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17

46	4	21	37	8	11
48	2	14	1		
61	2	36	24		
65	2	7	36		
76	2	0	27		
81	2	7	34		
83	3	36	6	25	
85	2	36	23		
87	2	21	8		
89	2	36	22		
91	3	36	17	30	
93	2	36	26		
95	2	36	23		

'aaaa

957	7268.79	229.832	80.625	11.488	5.24	319.15	31.63
	58.41	4.531	0.492	0.061	0.07	12.48	12.89 BUSES
	7210.38	225.301	80.133	11.427	5.17	306.68	32.00 OTHER

CPU TIME USED SO FAR IS 4.79 SECS



INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17 -1 7

46	4	37	8	11
48	2	1		
61	2	24		
65	2	36		
76	2	27		
81	2	34		
83	3	7	24	
85	2	23		
87	2	1		
89	2	15		
91	3	17	30	
93	2	26		
95	2	16		

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[illegible]



INTERMEDIATE SETTINGS - STEP	SIZES SO FAR	:	-	7	17	-1	7	17
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46	4	21	37	8	11
48	2	14	1		
61	2	36	24		
65	2	3	36		
76	2	41	27		
81	2	5	34		
83	3	36	7	24	
85	2	36	23		
87	2	14	1		
89	2	28	15		
91	3	36	17	30	
93	2	36	26		
95	2	29	16		

[illegible]

INTERMEDIATE SETTINGS	-	STEP	SIZES	SO FAR	:-	7	17	-1	7	17	1	-1
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46	4	20	36
48	2	16	3
61	2	36	24
65	2	3	36
76	2	40	26
81	2	5	34
83	3	34	5
85	2	35	22
87	2	14	1
89	2	33	20
91	3	37	18
93	2	33	23
95	2	26	12

caaaa

897

32

7268 79

559 228

7C 134

4A E07

;

58.41

4.482

Q 447

0 057

007

11

3

10

7210.38

224 177

75 987

44 150

L
C
A

1
 2
 3
 4
 5

CPU TIME USED SO FAR IS	13.96 SECS
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FINAL SETTINGS OBTAINED WITH STEP SIZES :- 7 17 -1 7 17 1 -1 1

LINK NUMBER	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
46	4	20	36	7	10				1.163	0.958	0.08 (65%)	9	46	77	20
48	2	16	3						0.988	0.129	0.10 (38%)	11	46	25	72
61	2	35	23						3.073	0.130	0.10 (80%)	9	46	77	14
65	2	3	36						3.455	0.125	0.12 (58%)	12	46	43	72
76	2	40	26						0.208	0.017	0.01 (10%)	1	46	77	20
81	2	5	34						2.030	1.231	0.06 (82%)	6	46	25	42
83	3	33	4	21					0.290	0.010	0.02 (43%)	1	46	77	40
85	2	35	22						0.082	0.005	0.00 (36%)	11	46	25	72
87	2	14	1						0.496	0.026	0.01 (33%)	1	48	11	32
89	2	33	20						0.457	0.054	0.03 (12%)	4	48	37	6
91	3	37	18	31					0.905	0.022	0.03 (75%)	2	48	11	32
93	2	32	22						1.211	0.025	0.08 (38%)	7	48	37	6
95	2	25	11						0.004	0.002	0.00 (8%)	4	48	37	6
461	447	1550		83	104.60	4.736	1.163		0.681	0.646	0.04 (20%)	4	61	75	46
462	937	3410S		51	228.63	7.649	0.988		1.180	0.056	0.04 (80%)	3	61	51	70
463	439	3100		51	103.16	3.203	3.073		0.665	0.026	0.04 (29%)	4	61	75	46
464	757	4340		50	92.35	5.889	3.455		1.773	0.169	0.05 (87%)	4	65	77	6
465	224	2790		23	52.42	1.536	0.208		0.450	0.042	0.03 (19%)	3	65	11	72
466	279	1550		86	68.08	5.206	2.030		1.589	0.145	0.05 (89%)	4	65	77	6
467	131	1240		18	30.78	0.300	0.290		0.326	0.009	0.03 (28%)	2	65	11	72
468*	36	462L		51	8.78	0.721	0.082		0.552	0.039	0.04 (31%)	3	76	85	52
481	142	2015		28	33.65	1.364	0.496		1.845	1.348	0.13 (80%)	12	81	73	10
482	944	4030S		37	115.17	3.801	0.457		1.254	0.382	0.12 (25%)	14	81	15	68
483	132	2015		26	31.02	0.927	0.905		3.944	1.004	0.12 (89%)	11	81	73	10
484	735	4154		27	89.67	1.237	1.211		1.181	0.018	0.06 (36%)	5	81	15	68
488*	40	482L		37	4.88	0.180	0.004		0.060	0.008	0.00 (35%)	14	81	15	68
612	726	1395		77	88.57	3.857	0.681		0.054	0.000	0.00 (61%)	0	83	13	42
613	175	2015		37	41.13	2.264	1.180		1.357	0.131	0.07 (56%)	6	83	47	8
614	512	2759		28	124.93	3.204	0.665		3.258	2.512	0.11 (89%)	10	83	13	42
651	207	2015		55	103.50	1.943	1.773		1.069	0.050	0.03 (73%)	3	83	69	8
652	647	2682		33	78.93	2.747	0.450		2.413	0.606	0.07 (88%)	7	83	47	68
653	197	2015		53	46.69	2.901	1.589		0.295	0.034	0.03 (39%)	3	83	13	66
654	336	2666		17	40.99	0.335	0.326								
761	806	3519		82	143.47	7.206	6.281								
762	574	1395		66	70.03	2.912	0.601								
763	549	3255		60	128.47	8.342	4.901								
764	415	2046		32	50.63	1.857	0.552								
811	577	2387		87	134.44	6.554	1.845								
812	1650	3875S		69	400.95	13.092	1.254								
813	504	2170		83	252.00	4.948	3.944								
814	567	3875		23	138.35	4.658	1.181								
818*	36	812L		69	8.75	0.723	0.060								
831	11	1240		3	5.50	0.054	0.054								
832	440	1550		51	220.00	1.488	1.357								
833	451	1395		93	105.08	8.397	3.258								
834	168	1550		36	82.32	3.177	1.069								
836	303	1550		76	151.50	3.019	2.413								
837	268	1395		31	62.44	1.889	0.295								

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	GREEN PERIOD END (SEC)
838	347	2790	41	170.03	6.483	2.161	0.072	0.07 (77%)	6	83	69	8
852	1463	3472S	66	570.57	14.801	1.804	0.318	0.11 (26%)	11	85	75	44
854	549	4340	19	133.41	3.844	0.498	0.012	0.03 (18%)	3	85	75	44
858*	36	852L	66	14.04	1.149	0.084	0.008	0.01 (51%)	11	85	75	44
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	7	28
872	1287	3348S	61	314.03	10.453	1.253	0.228	0.07 (20%)	7	87	33	2
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	7	28
874	613	3379	28	149.57	5.250	1.484	0.027	0.11 (63%)	10	87	33	2
878*	36	872L	61	8.78	0.731	0.079	0.006	0.00 (46%)	7	87	33	2
891	173	1085	62	40.65	3.151	1.880	0.255	0.04 (88%)	4	89	45	66
892	1253	3364S	59	305.73	10.667	1.727	0.204	0.17 (49%)	17	89	71	40
893	106	1085	38	53.00	0.811	0.752	0.059	0.02 (78%)	2	89	45	66
894	704	2945	37	85.89	2.472	0.272	0.053	0.01 (6%)	1	89	71	40
898*	36	892L	59	8.78	0.716	0.055	0.006	0.00 (41%)	17	89	71	40
912	1370	3255S	81	167.14	8.083	2.488	0.819	0.12 (32%)	21	91	77	36
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	41	62
914	838	3100	42	204.47	5.816	0.631	0.073	0.09 (37%)	10	91	67	36
918*	36	912L	81	4.39	0.258	0.080	0.022	0.00 (36%)	21	91	77	36
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	49	64
932	671	1395	67	328.79	10.581	0.854	0.333	0.08 (44%)	8	93	69	44
933	72	1085	36	16.92	1.065	0.592	0.049	0.02 (86%)	2	93	49	64
934	412	3643	16	50.26	1.650	0.386	0.007	0.03 (23%)	2	93	69	44
951	248	4294	21	176.08	5.355	1.429	0.013	0.03 (48%)	3	95	27	50
952	1105	3472S	52	552.50	2.689	2.550	0.139	0.15 (50%)	15	95	55	22
953	111	1240	41	55.50	0.928	0.859	0.069	0.03 (82%)	2	95	32	50
954	537	4340	20	209.43	5.960	1.294	0.012	0.07 (49%)	6	95	55	22
958	36	952L	52	18.00	0.088	0.083	0.005	0.00 (50%)	15	95	55	22
'aaaa												
				TOTAL	TOTAL	TOTAL	TOTAL	TOTAL	PERFORMANCE INDEX	SPEED		
				DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)		(KM/H)		
				7268.79	228.417	76.192	14.507	4.43	280.69	31.82		
				58.41	4.479	0.443	0.057	0.07	11.44	13.04	BUSES	
				7210.38	223.939	75.748	14.450	4.36	269.25	32.20	OTHER	

CPU TIME USED SO FAR IS 15.80 SECS

APPENDIX IX

Significance Testing of the Operating and Running Speeds
on Jasper Avenue from 111 Street to 117 Street

AM EASTBOUND AUTO OPERATING SPEED

Before $n=12$ $\bar{x}=18.07$ $s=4.68$

After $n=12$ $\bar{x}=25.69$ $s=6.25$

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_0 = \frac{\sqrt{\frac{n_1 n_2 (n_1 + n_2 - 2)}{n_1 + n_2}} \frac{\bar{x} - \bar{y}}{\sqrt{((n_1 - 1)s_x^2 + (n_2 - 1)s_y^2)}}$$

$$= \frac{\sqrt{\frac{12 \times 12 (12 + 12 - 2)}{12 + 12}} \frac{25.67 - 18.07}{\sqrt{11 \times 6.25^2 + 11 \times 4.68^2}}$$

$$= 3.381$$

For 95% confidence

$$t_{.025, 22} = 2.074$$

$$< t_0$$

Null hypothesis is rejected.

There is a significant difference between the before and after cases.

AM EASTBOUND AUTO RUNNING SPEED

Before n=12 x=29.53 s=2.57

After n=12 x=37.31 s=4.36

Null hypothesis $H_0 : u_A = u_B$

Alternate hypothesis $H_1 : u_A \neq u_B$

$$t_0 = \frac{12 \times 12 (12 + 12 - 2)}{12 + 12} \frac{37.31 - 29.53}{\sqrt{11 \times 2.57^2 + 11 \times 4.36^2}}$$

$$= 5.325$$

For 95% confidence

$$t_{.025, 22} = 2.074$$

$$< t_0$$

Null hypothesis is rejected.

There is a significant difference in the running speeds for the before and after cases.

AM EASTBOUND BUS OPERATING SPEED

Before $n=15$ $\bar{x}=12.54$ $s=2.86$

After $n=15$ $\bar{x}=13.79$ $s=1.68$

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_0 = \frac{15 \times 15 (\bar{x}_1 - \bar{x}_2)}{15 + 15} \frac{13.79 - 12.54}{\sqrt{14 \times 2.86^2 + 14 \times 1.68^2}}$$

$$= 1.460$$

For 95% confidence

$$t_{.025, 28} = 2.048$$

$$> t_0$$

Null hypothesis is accepted.

There is no difference between the population mean of operating speeds for the before and after cases.

AM EASTBOUND BUS RUNNING SPEED

Before $n=15$ $\bar{x}=25.56$ $s=5.05$

After $n=15$ $\bar{x}=27.78$ $s=2.38$

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_0 = \frac{\bar{x}_2 - \bar{x}_1}{\sqrt{\frac{15 \times 15 (15 + 15 - 2)}{15 + 15} \left(\frac{27.78 - 25.56}{\sqrt{14 \times 5.05^2 + 14 \times 2.38^2}} \right)}}$$

$$= 1.540$$

For 95% confidence

$$t_{.025, 28} = 2.048$$

$$> t_0$$

Null hypothesis is accepted.

There is no difference in the running speeds for the before and after cases.

AM WESTBOUND AUTO OPERATING SPEED

Before n=12 x=24.19 s=2.97

After n=12 x=28.13 s=4.72

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_o = \frac{28.13 - 24.19}{\sqrt{\frac{12 \times 12 (12 + 12 - 2)}{12 + 12} \left(\frac{2.97^2}{11} + \frac{4.72^2}{11} \right)}}$$

$$= 2.447$$

For 95% confidence

$$t_{.025, 22} = 2.074$$

$$< t_o$$

Null hypothesis is rejected.

Alternate hypothesis is accepted and there is a significant difference between the operating speeds of the before and after cases.

AM WESTBOUND AUTO RUNNING SPEED

Before $n=12$ $\bar{x}=35.83$ $s=2.93$

After $n=12$ $\bar{x}=39.32$ $s=3.36$

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_0 = \frac{12 \times 12 (\bar{x}_2 - \bar{x}_1)}{\sqrt{12 + 12} \sqrt{11 \times 2.93^2 + 11 \times 3.36^2}}$$

$$= 2.712$$

For 95% confidence

$$t_{.025, 22} = 2.074$$

$$< t_0$$

Null hypothesis is rejected.

There is a difference in the population mean of the running speeds for the before and after cases.

AM WESTBOUND BUS OPERATING SPEED

Before $n=14$ $\bar{x}=16.86$ $s=1.92$

After $n=14$ $\bar{x}=20.46$ $s=2.33$

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_o = \frac{\bar{x}_2 - \bar{x}_1}{\sqrt{\frac{14 \times 14 (14 + 14 - 2)}{14 + 14} \left(\frac{1.92^2 + 2.33^2}{2} \right)}} = 4.462$$

For 95% confidence

$$t_{.025, 26} = 2.056$$

$$< t_o$$

Null hypothesis is rejected.

There is a significant difference between the operating speeds for the before and after cases.

AM WESTBOUND BUS RUNNING SPEED

Before $n=14$ $\bar{x}=25.15$ $s=1.69$

After $n=14$ $\bar{x}=30.42$ $s=2.42$

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_0 = \frac{\bar{x}_2 - \bar{x}_1}{\sqrt{\frac{14 \times 14 (14 + 14 - 2)}{14 + 14} \left(\frac{30.42 - 25.12}{\sqrt{13 \times 1.69^2 + 13 \times 2.42^2}} \right)}}$$

$$= 6.680$$

For 95% confidence

$$t_{.025, 26} = 2.056$$

$$> t_0$$

Null hypothesis is rejected.

There is a significant difference in the running speeds for the before and after cases.

PM EASTBOUND AUTO OPERATING SPEED

Before $n=12$ $\bar{x}=18.51$ $s=2.30$

After $n=12$ $\bar{x}=20.74$ $s=3.05$

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_0 = \frac{\bar{x}_2 - \bar{x}_1}{\sqrt{\frac{12 \times 12 (12 + 12 - 2)}{12 + 12} \left(\frac{2.30^2 + 3.05^2}{2} \right)}} \frac{20.74 - 18.51}{\sqrt{11 \times 2.30^2 + 11 \times 3.05^2}}$$

$$= 2.022$$

For 95% confidence

$$t_{.025, 22} = 2.074$$

$$> t_0$$

Null hypothesis is accepted.

There is no difference in the operating speeds between the before and after cases.

PM EASTBOUND AUTO RUNNING SPEED

Before	n=12	x=35.44	s=4.92
After	n=12	x=36.75	s=2.70

Null hypothesis $H_0 : u_A = u_B$

Alternate hypothesis $H_1 : u_A \neq u_B$

$$\begin{aligned}
 t_0 &= \frac{\sqrt{\frac{12 \times 12 (12 + 12 - 2)}{12 + 12}}}{\sqrt{11 \times 2.70^2 + 11 \times 4.92^2}} \frac{36.75 - 35.44}{1} \\
 &= 0.809
 \end{aligned}$$

For 95% confidence

$$\begin{aligned}
 t_{.025, 22} &= 2.074 \\
 &> t_0
 \end{aligned}$$

Null hypothesis is accepted.

There is no difference in the running speeds for the before and after cases.

PM EASTBOUND BUS OPERATING SPEED

Before $n=13$ $\bar{x}=12.89$ $s=2.21$

After $n=13$ $\bar{x}=14.06$ $s=3.17$

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_o = \frac{\bar{x}_2 - \bar{x}_1}{\sqrt{\frac{13 \times 13 (13 + 13 - 2)}{13 + 13} \left(\frac{14.06 - 12.89}{\sqrt{12 \times 2.21^2 + 12 \times 3.17^2}} \right)}}$$

$$= 1.092$$

For 95% confidence

$$t_{.025, 24} = 2.064$$

$$> t_o$$

Null hypothesis is accepted.

There is no difference in the population means of the operating speed between the before and after cases.

PM EASTBOUND BUS RUNNING SPEED

Before $n=13$ $\bar{x}=25.94$ $s=2.97$

After $n=13$ $\bar{x}=29.84$ $s=5.29$

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_o = \frac{\bar{x}_2 - \bar{x}_1}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}} = \frac{29.84 - 25.94}{\sqrt{\frac{12 \times 2.97^2}{13} + \frac{12 \times 5.29^2}{13}}}$$

$$= 2.318$$

For 95% confidence

$$t_{.025, 24} = 2.064$$

$$< t_o$$

Null hypothesis is rejected.

There is a significant difference in the running speeds for the before and after cases.

PM WESTBOUND AUTO OPERATING SPEED

Before $n=12$ $\bar{x}=22.79$ $s=5.34$

After $n=12$ $\bar{x}=22.81$ $s=7.52$

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_0 = \frac{22.81 - 22.79}{\sqrt{\frac{12 \times 12 (12 + 12 - 2)}{12 + 12} \left(\frac{5.34^2}{11} + \frac{7.52^2}{11} \right)}}$$

$$= 0.008$$

For 95% confidence

$$t_{.025, 22} = 2.074$$

$$> t_0$$

Null hypothesis is accepted.

There is no difference between the before and after cases.

PM WESTBOUND AUTO RUNNING SPEED

Before	n=12	x=28.96	s=4.08
After	n=12	x=34.47	s=3.67

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$\begin{aligned}
 t_o &= \frac{34.47 - 28.96}{\sqrt{\frac{12 \times 12 (12 + 12 - 2)}{12 + 12} \left(\frac{11 \times 3.67^2 + 11 \times 4.08^2}{12 + 12} \right)}} \\
 &= 3.478
 \end{aligned}$$

For 95% confidence

$$\begin{aligned}
 t_{.025, 22} &= 2.074 \\
 &< t_o
 \end{aligned}$$

Null hypothesis is rejected.

There is a significant difference in the population mean of the running speeds between the before and after cases.

PM WESTBOUND BUS OPERATING SPEED

Before	n=14	x=15.29	s=2.41
After	n=14	x=15.39	s=2.58

Null hypothesis $H_0 : u_A = u_B$

Alternate hypothesis $H_1 : u_A \neq u_B$

$$\begin{aligned}
 t_o &= \frac{14 \times 14 (14 + 14 - 2)}{14 + 14} \frac{15.39 - 15.29}{\sqrt{13 \times 2.41^2 + 13 \times 2.58^2}} \\
 &= 0.106
 \end{aligned}$$

For 95% confidence

$$\begin{aligned}
 t_{.025, 26} &= 2.056 \\
 &> t_o
 \end{aligned}$$

Null hypothesis is accepted.

There is no difference between the operating speeds for the before and after cases.

PM WESTBOUND BUS RUNNING SPEED

Before n=14 x=25.20 s=2.42

After n=14 x=27.03 s=2.69

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_o = \frac{\sqrt{14 \times 14 (14 + 14 - 2)}}{14 + 14} \frac{27.03 - 25.20}{\sqrt{13 \times 2.42^2 + 13 \times 2.69^2}}$$

$$= 1.892$$

For 95% confidence

$$t_{.025, 26} = 2.056$$

$$> t_o$$

Null hypothesis is accepted.

There is no difference in the running speeds for the before and after cases.

APPENDIX X

Significance Testing of the Total Average Approach Delay
on Jasper Avenue from 111 Street to 117 Street

AM EASTBOUND AUTO (TOTAL AVERAGE APPROACH DELAY)

Before n=48 x=17.21 s=19.98

After n=48 x= 9.83 s=14.35

Null hypothesis $H_0 : u_A = u_B$

Alternate hypothesis $H_1 : u_A \neq u_B$

$$\begin{aligned}
 t_o &= \frac{\sqrt{\frac{n_1 n_2 (n_1 + n_2 - 2)}{n_1 + n_2}}}{\sqrt{\frac{(n_1 - 1)s_x^2 + (n_2 - 1)s_y^2}{n_1 + n_2}}} \frac{x - y}{\sqrt{\frac{(n_1 - 1)s_x^2 + (n_2 - 1)s_y^2}{n_1 + n_2}}} \\
 &= \frac{\sqrt{\frac{48 \times 48 (48 + 48 - 2)}{48 + 48}}}{\sqrt{\frac{47 \times 14.35^2 + 47 \times 19.98^2}{48 + 48}}} \frac{17.21 - 9.83}{\sqrt{\frac{47 \times 14.35^2 + 47 \times 19.98^2}{48 + 48}}} \\
 &= 2.079
 \end{aligned}$$

For 95% confidence

$$t_{.025, 94} = 1.960$$

$$< t_o$$

Null hypothesis is rejected.

There is a significant difference in the total average approach delay between the before and after cases.

AM EASTBOUND BUS (TOTAL AVERAGE APPROACH DELAY)

Before	n=60	x=11.68	s=14.33
After	n=60	x= 6.90	s=12.04

Null hypothesis $H_0 : u_A = u_B$

Alternate hypothesis $H_1 : u_A \neq u_B$

$$t_o = \frac{11.68 - 6.90}{\sqrt{\frac{60 \times 60 (60 + 60 - 2)}{60 + 60} \left(\frac{14.33^2}{59} + \frac{12.04^2}{59} \right)}}$$

$$= 1.978$$

For 95% confidence

$$t_{.025, 118} = 1.960$$

$$< t_o$$

Null hypothesis is rejected.

There is a significant difference in the total average approach delay between the before and after cases.

AM WESTBOUND AUTO (TOTAL AVERAGE APPROACH DELAY)

Before	n=36	x=12.25	s=12.92
After	n=36	x=10.50	s=13.10

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_o = \frac{36 \times 36 (36 + 36 - 2)}{36 + 36} \frac{12.25 - 10.50}{\sqrt{35 \times 12.92^2 + 35 \times 13.10^2}}$$

$$= 0.571$$

For 95% confidence

$$t_{.025, 70} = 1.960$$

$$> t_o$$

Null hypothesis is accepted.

There is no difference in the total average approach delay between the before and after cases.

AM WESTBOUND BUS (TOTAL AVERAGE APPROACH DELAY)

Before n=42 x=8.74 s=12.41

After n=42 x=5.67 s= 9.64

Null hypothesis $H_0 : u_A = u_B$

Alternate hypothesis $H_1 : u_A \neq u_B$

$$t_o = \frac{8.74 - 5.67}{\sqrt{\frac{42 \times 42 (42 + 42 - 2)}{42 + 42} \left(\frac{12.41^2}{41} + \frac{9.64^2}{41} \right)}}$$

$$= 1.266$$

For 95% confidence

$$t_{.025, 82} = 1.960$$

$$> t_o$$

Null hypothesis is accepted.

There is no difference in the total average approach delay between the before and after cases.

PM EASTBOUND AUTO (TOTAL AVERAGE APPROACH DELAY)

Before	n=48	x=18.33	s=17.31
After	n=48	x=17.08	s=15.54

Null hypothesis $H_0 : u_A = u_B$

Alternate hypothesis $H_1 : u_A \neq u_B$

$$t_o = \frac{18.33 - 17.08}{\sqrt{\frac{48 \times 48 (48 + 48 - 2)}{48 + 48} \left(\frac{17.31^2}{47} + \frac{15.54^2}{47} \right)}}$$

$$= 0.372$$

For 95% confidence

$$t_{.025, 94} = 1.960$$

$$> t_o$$

Null hypothesis is accepted.

There is no difference in the total average approach delay between the before and after cases.

PM EASTBOUND BUS (TOTAL AVERAGE APPROACH DELAY)

Before	n=52	x=15.04	s=15.77
After	n=52	x=13.00	s=16.45

Null hypothesis $H_0 : u_A = u_B$

Alternate hypothesis $H_1 : u_A \neq u_B$

$$t_o = \frac{52 \times 52 (52 + 52 - 2)}{52 + 52} \frac{15.04 - 13.00}{\sqrt{51 \times 15.77^2 + 51 \times 16.45^2}}$$

$$= 0.646$$

For 95% confidence

$$t_{.025, 102} = 1.960$$

$$> t_o$$

Null hypothesis is accepted.

There is no difference in the total average approach delay between the before and after cases.

PM WESTBOUND AUTO (TOTAL AVERAGE APPROACH DELAY)

Before n=36 x=17.58 s=16.76

After n=36 x= 8.42 s=14.46

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_0 = \frac{17.58 - 8.42}{\sqrt{\frac{36 \times 36 (36 + 36 - 2)}{36 + 36} \left(\frac{1}{35 \times 16.76^2} + \frac{1}{35 \times 14.46^2} \right)}}$$

$$= 2.483$$

For 95% confidence

$$t_{.025,70} = 1.960$$

$$< t_0$$

Null hypothesis is rejected.

There is a significant difference in the total average approach delay between the before and after cases.

PM WESTBOUND BUS (TOTAL AVERAGE APPROACH DELAY)

Before n=42 x=10.43 s=14.77

After n=42 x= 8.48 s=12.11

Null hypothesis $H_0 : \mu_A = \mu_B$

Alternate hypothesis $H_1 : \mu_A \neq \mu_B$

$$t_0 = \frac{10.43 - 8.48}{\sqrt{\frac{42 \times 42 (42 + 42 - 2)}{42 + 42} \left(\frac{14.77^2}{41} + \frac{12.11^2}{41} \right)}}$$

$$= 0.662$$

For 95% confidence

$$t_{.025, 82} = 1.960$$

$$> t_0$$

Null hypothesis is accepted.

There is no difference in the total average approach delay between the before and after cases.

APPENDIX XI

TRANSYT Output for the AM Peak with Two Bus Links
and a Bus Delay Weighting of 30

CBD WEST NETWORK - 108-121 STREET AM PEAK

TRANSYT/7

CARD NO.	CARD TYPE	CYCLE TIME	STEPS PER CYC.	STOP PERIOD	LAG START	LAG END	WEIGHT+ EQUISAT	J.T./S	MARKERS PRINT	CHECK	STEPS OR SECS	SCALE FLOWS	NO.OF COPIES
1	1	86	43	20	60	2	3	1	0	0	0	0	0

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE	85	81	87	89	91	46	48	83	93	61	76	65	0	0
2	2	95													

HILLCLIMB STEP-SIZE LIST

CARD NO.	CARD TYPE	7	17	7	17	1	-1	1	0	0	0	0	0	0	0
3	4														

REDUCTION OF STOP PENALTY FOR SHORT DELAYS (IN STEPS) OF

CARD NO.	CARD TYPE	UPPER LIMIT	1	2	3	4	5	6	7	8	9	10	11	12	13	14
4	5	4	62	83	96	99	0	0	0	0	0	0	0	0	0	0

LINKS HAVING SHARED STOPLINES

CARD NO.	CARD TYPE	FIRST SET	SECOND SET	THIRD SET
5	7	482	488	0
6	7	892	898	899
7	7	852	858	859
			462	468
			872	878
			952	958
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CARD NO.	CARD TYPE	NO.	STAGE 1	MIN	CHANGE	STAGE 2	MIN	CHANGE	STAGE 3	MIN	CHANGE	STAGE 4	MIN	CHANGE	STAGE 5	MIN	CHANGE	STAGE 6	MIN	CHANGE	STAGE 7	MIN
8	12	95	0	26	20	26	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	12	85	0	10	15	26	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	12	81	0	22	20	28	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	12	87	0	21	20	26	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	12	89	0	21	20	26	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	13	91	0	23	15	26	26	30	11	0	0	0	0	0	0	0	0	0	0	0	0	0
14	14	46	0	32	16	28	28	30	6	0	33	20	0	0	0	0	0	0	0	0	0	0
15	12	48	0	22	15	26	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	13	83	0	25	15	26	26	30	13	0	0	0	0	0	0	0	0	0	0	0	0	0
17	12	93	0	17	15	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	12	61	0	20	15	24	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	12	76	0	28	15	23	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	12	65	0	22	15	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN	STAGE	LAG	END	SECOND GREEN	STAGE	LAG	END	LINK LENGTH	STOP PENALTY	SAT FLOW	DELAY WT.X100	DISPSN X100
21	31	951	95	2	5	0	0	0	0	0	0	710	1	4294	0	0
22	31	952	95	1	5	0	0	0	0	0	0	500	1	3472	500	0
23	31	953	95	2	10	0	0	0	0	0	0	500	1	1240	0	0
24	31	954	95	1	5	0	0	0	0	0	0	390	1	4340	0	0
25	31	958	0	0	0	0	0	0	0	0	0	500	1	0	3000	0
26	31	852	85	1	5	0	0	0	0	0	0	390	10	3472	500	0
27	31	854	85	1	5	0	0	0	0	0	0	243	1	4340	0	0
28	31	858	0	0	0	0	0	0	0	0	0	390	10	0	3000	0

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY A LINK NO.	ENTRY A FLOW	ENTRY A TRAVEL TIME	ENTRY B LINK NO.	ENTRY B FLOW	ENTRY B TRAVEL TIME	ENTRY C LINK NO.	ENTRY C FLOW	ENTRY C TRAVEL TIME	ENTRY D LINK NO.	ENTRY D FLOW	ENTRY D TRAVEL TIME
88	32	951	248	0	0	0	0	838	248	45	0	0	45	0	0	0
89	32	952	1063	0	0	0	0	0	0	0	0	0	0	0	0	0
90	32	953	111	0	0	0	0	0	0	0	0	0	0	0	0	0
91	32	954	537	0	0	0	0	854	537	45	0	0	45	0	0	0
92	32	958	50	0	0	0	0	0	0	0	0	0	0	0	0	0
93	32	852	1421	0	953	111	45	952	1060	45	951	18	45	0	0	0
94	32	854	549	0	811	98	40	814	493	40	813	51	40	0	0	0
95	32	858	36	0	0	0	0	958	36	2644	0	0	2644	0	0	0
96	32	859	14	0	0	0	0	958	14	2800	0	0	2800	0	0	0
97	32	811	577	0	836	449	40	0	0	0	838	99	40	0	0	0
98	32	812	1608	0	0	0	0	852	1419	35	0	0	35	0	0	0
99	32	813	504	0	0	0	0	0	0	0	0	0	0	0	0	0
100	32	814	567	0	871	28	40	874	574	40	873	10	40	0	0	0
101	32	818	36	0	0	0	0	858	36	2422	0	0	2422	0	0	0
102	32	819	14	0	0	0	0	859	14	2800	0	0	2800	0	0	0
103	32	871	95	0	0	0	0	0	0	0	0	0	0	0	0	0
104	32	872	1245	0	813	85	35	812	1233	35	811	27	35	0	0	0
105	32	873	46	0	0	0	0	0	0	0	0	0	0	0	0	0
106	32	874	613	0	891	32	40	894	606	40	893	15	40	0	0	0
107	32	878	36	0	0	0	0	818	36	2623	0	0	2623	0	0	0
108	32	879	14	0	0	0	0	819	14	2800	0	0	2800	0	0	0
109	32	891	173	0	0	0	0	931	80	40	934	73	40	0	0	0
110	32	892	1211	0	873	24	35	872	1221	35	871	33	35	0	0	0
111	32	893	106	0	0	0	0	0	0	0	0	0	0	0	0	0
112	32	894	704	0	0	0	0	914	662	40	913	13	40	0	0	0
113	32	898	36	0	0	0	0	878	36	2422	0	0	2422	0	0	0
114	32	899	14	0	0	0	0	879	14	2800	0	0	2800	0	0	0
115	32	912	1328	0	893	68	35	892	1164	35	891	51	35	0	0	0
116	32	913	115	0	0	0	0	0	0	0	0	0	0	0	0	0
117	32	914	838	0	461	71	40	464	619	40	467	131	40	0	0	0
118	32	918	50	0	0	0	0	898	36	2800	0	0	2800	899	14	2800
119	32	461	447	0	0	0	0	761	368	40	764	65	40	0	0	0
120	32	462	925	0	913	59	35	912	960	35	0	0	0	0	0	0
121	32	463	439	0	0	0	0	0	0	0	0	0	0	0	0	0
122	32	464	757	0	481	40	40	484	663	40	483	40	40	0	0	0
123	32	465	224	0	0	0	0	761	224	40	0	0	40	0	0	0
124	32	466	249	0	0	0	0	912	249	35	0	0	0	0	0	0
125	32	467	131	0	0	0	0	0	0	0	0	0	0	0	0	0
126	32	468	36	0	0	0	0	918	36	2622	0	0	2622	0	0	0
127	32	469	10	0	0	0	0	918	10	2800	0	0	2800	0	0	0
128	32	481	142	0	652	14	40	651	127	40	654	24	40	0	0	0
129	32	482	944	0	0	0	0	462	772	35	465	89	35	0	0	0
130	32	483	132	0	0	0	0	0	0	0	0	0	0	0	0	0
131	32	484	735	0	0	0	0	0	0	0	0	0	0	0	0	0
132	32	488	40	0	0	0	0	468	36	2800	0	0	2800	0	0	0
133	32	831	11	0	0	0	0	0	0	0	0	0	0	0	0	0
134	32	832	440	0	0	0	0	0	0	0	0	0	0	0	0	0
135	32	833	451	0	0	0	0	813	137	40	812	237	40	0	0	0
136	32	834	168	0	931	18	40	934	116	40	933	12	40	0	0	0
137	32	836	303	0	0	0	0	0	0	0	0	0	0	0	0	0
138	32	837	268	0	814	12	40	813	231	40	812	100	40	0	0	0
139	32	838	347	0	931	18	40	934	219	40	0	0	40	0	0	0
140	32	931	122	0	0	0	0	0	0	0	0	0	0	0	0	0
141	32	932	671	0	833	443	35	832	429	35	0	0	35	0	0	0
142	32	933	72	0	894	34	40	893	23	40	892	38	40	0	0	0
143	32	934	412	0	0	0	0	614	500	40	613	32	40	0	0	0

[illegible]

INITIAL SETTINGS

LINK NUMBER	NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
			STAGE FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)									
461	46	4	0	16	30	33	8.283	4.711	0.958	0.12 (99%)	11	46	37	66
462	48	2	0	30			11.856	5.284	0.124	0.21 (83%)	19	46	71	32
463	61	2	0	31			3.203	3.073	0.130	0.10 (80%)	9	46	37	60
464	65	2	0	29			6.129	3.695	0.125	0.11 (52%)	9	46	3	32
465	76	2	0	27			3.384	2.056	0.017	0.06 (99%)	5	46	37	66
466	81	2	0	27			4.359	1.890	0.734	0.07 (98%)	6	46	71	2
467	83	3	0	13	32		0.300	0.290	0.010	0.02 (43%)	1	46	37	0
468	85	2	0	30			0.764	0.125	0.005	0.01 (72%)	19	46	71	32
469	87	2	0	30			0.186	0.069	0.029	0.00 (99%)	6	46	71	2
481	89	2	0	29			2.211	1.344	0.026	0.03 (73%)	2	48	65	0
482	91	3	0	24	37		4.183	0.839	0.054	0.14 (54%)	15	48	5	60
483	93	2	0	33			0.927	0.905	0.022	0.03 (75%)	2	48	65	0
484	95	2	0	30			1.237	1.211	0.025	0.08 (38%)	7	48	5	60
488		40	482L	37	4.88		0.195	0.019	0.002	0.00 (40%)	15	48	5	60
612		726	1395	77	88.57		4.042	0.866	0.646	0.05 (23%)	4	61	5	62
613		175	2015	37	41.13		2.192	1.109	0.056	0.04 (81%)	3	61	67	0
614		512	2759	28	124.93		3.047	0.508	0.026	0.04 (25%)	3	61	5	62
651		207	2015	37	103.50		1.437	1.383	0.054	0.04 (75%)	4	65	63	0
652		647	2682	38	78.93		3.438	1.123	0.060	0.06 (31%)	5	65	5	58
653		197	2015	35	46.69		2.802	1.587	0.047	0.04 (80%)	4	65	63	0
654		336	2666	20	40.99		0.608	0.595	0.012	0.04 (38%)	3	65	5	58
761		806	3519	70	143.47		5.896	5.480	0.415	0.18 (82%)	16	76	59	0
762		574	1395	71	70.03		3.981	1.555	0.426	0.06 (37%)	6	76	5	54
763		549	3255	52	128.47		5.715	2.365	0.139	0.11 (74%)	11	76	59	0
764		415	2046	35	50.63		2.212	0.899	0.047	0.05 (39%)	4	76	5	54
811		577	2387	74	134.44		11.535	7.644	0.530	0.15 (96%)	13	81	59	0
812		1608	3875S	74	390.74		18.297	6.637	0.496	0.25 (56%)	22	81	5	54
813		504	2170	71	252.00		3.883	3.442	0.440	0.12 (83%)	10	81	59	0
814		567	3875	25	138.35		4.739	1.259	0.021	0.06 (38%)	5	81	5	54
818		36	812L	74	8.75		0.851	0.186	0.011	0.01 (80%)	22	81	5	54
819		14	812L	74	3.40		0.160	0.034	0.004	0.00 (38%)	22	81	5	54
831		11	1240	2	5.50		0.046	0.046	0.000	0.00 (57%)	0	83	31	64
832		440	1550	55	220.00		1.840	1.667	0.172	0.08 (63%)	7	83	69	26
833		451	1395	82	105.08		6.201	2.680	0.894	0.11 (85%)	9	83	31	64
834		168	1550	39	82.32		3.226	1.106	0.062	0.04 (76%)	3	83	3	26

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN PERIOD START (SEC)	GREEN PERIOD END (SEC)
836	303	1550	84	151.50	3.623	2.569	1.054	0.08 (91%)	7	83	69	2
837	268	1395	30	62.44	2.368	0.777	0.031	0.04 (52%)	3	83	31	0
838	347	2790	45	170.03	6.447	2.107	0.089	0.07 (77%)	6	83	3	26
852	1421	3472S	65	554.19	15.551	2.944	0.292	0.17 (42%)	15	85	5	60
854	549	4340	19	133.41	4.140	0.793	0.012	0.05 (33%)	4	85	5	60
858*	36	852L	65	14.04	1.140	0.076	0.007	0.01 (51%)	15	85	5	60
859*	14	852L	65	5.46	0.240	0.042	0.003	0.00 (60%)	15	85	5	60
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	65	0
872	1245	3348S	59	303.78	11.685	2.797	0.209	0.13 (39%)	13	87	5	60
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	65	0
874	613	3379	28	149.57	5.159	1.392	0.027	0.07 (44%)	7	87	5	60
878*	36	872L	59	8.78	0.784	0.133	0.006	0.01 (69%)	13	87	5	60
879*	14	872L	59	3.42	0.177	0.053	0.002	0.00 (60%)	13	87	5	60
891	173	1085	57	40.65	2.990	1.785	0.189	0.04 (89%)	4	89	63	0
892	1211	3364S	60	295.48	12.529	3.875	0.212	0.18 (53%)	16	89	5	58
893	106	1085	35	53.00	0.752	0.705	0.047	0.02 (75%)	2	89	63	0
894	704	2945	38	85.89	2.667	0.461	0.058	0.04 (22%)	5	89	5	58
898*	36	892L	60	8.78	0.800	0.138	0.006	0.01 (66%)	16	89	5	58
899*	14	892L	60	3.42	0.157	0.032	0.002	0.00 (40%)	16	89	5	58
912	1328	3255S	79	162.02	9.565	4.217	0.719	0.15 (40%)	15	91	3	48
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	53	74
914	838	3100	42	204.47	6.613	1.428	0.073	0.08 (33%)	7	91	79	48
918*	50	912L	79	6.10	0.382	0.137	0.027	0.00 (31%)	15	91	3	48
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	71	0
932	671	1395	67	328.79	10.729	1.002	0.333	0.09 (47%)	8	93	5	66
933	72	1085	36	16.92	1.011	0.539	0.049	0.02 (79%)	1	93	71	0
934	412	3643	16	50.26	1.487	0.224	0.007	0.01 (13%)	1	93	5	66
951	248	4294	23	176.08	4.899	0.969	0.016	0.04 (62%)	4	95	65	0
952	1063	3472S	49	531.50	2.237	2.123	0.114	0.14 (46%)	13	95	5	60
953	111	1240	45	55.50	1.005	0.912	0.093	0.03 (85%)	2	95	70	0
954	537	4340	19	209.43	5.604	0.939	0.011	0.06 (38%)	5	95	5	60
958	50	952L	49	25.00	0.105	0.100	0.005	0.01 (46%)	13	95	5	60

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
aaaa	1	83	7212.18	251.315	103.758	10.811	5.67	450.37	28.70
			78.25	5.837	1.044	0.106	0.12	36.90	13.41 BUSES
			7133.92	245.478	102.714	10.704	5.55	413.47	29.06 OTHER

CPU TIME USED SO FAR IS 1.01 SECS

INTERMEDIATE SETTINGS - STEP SIZES, SO FAR :- 7

Line	Account	Quantity	Unit Price	Amount	Tax	Total	Category
46	21	37	8	11			
48	14	1					
61	36	24					
65	7	36					
76	0	27					
81	7	34					
83	36	6	25				
85	36	23					
87	21	8					
89	36	22					
91	36	17	30				
93	36	26					
95	36	23					
aaaa	39	1419	7212.18	227.500	79.943	10.811	31.70
			78.25	5.474	0.680	0.106	14.30 BUSES
			7133.92	222.027	79.263	10.704	32.13 OTHER

CPU TIME USED SO FAR IS	3.60 SECS
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CPU TIME USED SO FAR IS 5.58 SECS

INTERMEDIATE SETTINGS - STEP SIZES. SO FAR :- 7 17 -1

46	4	21	37	8	11
48	2	14	1		
61	2	36	24		
65	2	3	36		
76	2	41	27		
81	2	5	34		
83	3	36	7	24	
85	2	36	23		
87	2	21	8		
89	2	35	22		
91	3	36	17	30	
93	2	36	26		
95	2	36	23		

}aaaa

973	7212.18	230.005	79.398	13.860	5.12	318.24	31.36
	78.25	5.429	0.641	0.101	0.10	24.27	14.41 BUSES
	7133.92	224.576	78.757	13.759	5.02	293.97	31.77 OTHER

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CPU TIME USED SO FAR IS      7.38 SECS

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INTERMEDIATE SETTINGS - STEP SIZES SO FAR :-										7	17	-1	7
46	4	21	37	8	11								
48	2	14	1										
61	2	36	24										
65	2	3	36										
76	2	41	27										
81	2	5	34										
83	3	36	7	24									
85	2	36	23										
87	2	14	1										
89	2	28	15										
91	3	36	17	30									
93	2	36	26										
95	2	29	16										
Paaaa				30	1097	7212.18	227.419	76					
						78.25	5.406	0					
						7133.92	222.013	76					
CPU TIME USED SO FAR IS										9.43 SECS			

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17 -1 7 17

46	4	21	37	8	11
48	2	14	1		
61	2	36	24		
65	2	3	36		
76	2	41	27		
81	2	5	34		
83	3	36	7	24	
85	2	36	23		
87	2	14	1		
89	2	28	15		
91	3	36	17	30	
93	2	36	26		
95	2	29	16		

	27	1019	7212.18	227.419	76.812	13.860	4.60	299.65	31.71
aaaa									
			78.25	5.406	0.619	0.101	0.10	23.53	14.47 BUSES
			7133.92	222.013	76.193	13.759	4.50	276.12	32.13 OTHER

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CPU TIME USED SO FAR IS      11.30 SECS

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INTERMEDIATE SETTINGS - STEP SIZES SO FAR :-

	4	20	36	7	10	7	17	-1	7	17	1	-1
46	4	20	36	7	10							
48	2	16	3									
61	2	36	24									
65	2	3	36									
76	2	40	26									
81	2	5	34									
83	3	34	5	22								
85	2	35	22									
87	2	14	1									
89	2	33	20									
91	3	37	18	31								
93	2	33	23									
95	2	26	12									
φaaaa	32	964		7212.18	226.498	75.904	13.848	4.38	290.11	31.84		
				78.25	5.405	0.617	0.101	0.09	23.36	14.48	BUSES	
				7133.92	221.093	75.287	13.747	4.29	266.75	32.27	OTHER	

CPU TIME USED SO FAR IS 15.48 SECS

FINAL SETTINGS OBTAINED WITH STEP SIZES :- 7 17 -1 7 17 1 -1 1

LINK NUMBER	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
46	4	20	36	7	10				1.163	0.958	0.08 (65%)	9	46	77	20
48	2	16	3						0.987	0.124	0.10 (38%)	11	46	25	72
61	2	35	23						3.073	0.130	0.10 (80%)	9	46	77	14
65	2	3	36						3.455	0.125	0.12 (58%)	12	46	43	72
76	2	40	26						0.208	0.017	0.01 (10%)	1	46	77	20
81	2	5	34						1.761	0.734	0.05 (79%)	5	46	25	42
83	3	33	4	21					0.290	0.010	0.02 (43%)	1	46	77	40
85	2	35	22						0.082	0.005	0.00 (36%)	11	46	25	72
87	2	14	1						0.072	0.029	0.00 (76%)	5	46	25	42
89	2	33	20						0.496	0.026	0.01 (33%)	1	48	11	32
91	3	37	18	31					0.457	0.054	0.03 (12%)	4	48	37	6
93	2	32	22						0.905	0.022	0.03 (75%)	2	48	11	32
95	2	25	11						1.211	0.025	0.08 (38%)	7	48	37	6
461	447	1550	83		104.60	4.736			0.004	0.002	0.00 (8%)	4	48	37	6
462	925	3410S	50		225.70	7.559			0.683	0.646	0.04 (20%)	4	61	75	46
463	439	3100	51		103.16	3.203			1.185	0.056	0.04 (80%)	3	61	51	70
464	757	4340	50		92.35	5.889			0.665	0.026	0.04 (29%)	4	61	75	46
465	224	2790	23		52.42	1.536			1.773	0.169	0.05 (87%)	4	65	77	6
466	249	1550S	80		60.76	4.231			0.450	0.042	0.03 (19%)	3	65	11	72
467	131	1240	18		30.78	0.300			1.587	0.145	0.05 (89%)	4	65	77	6
468*	36	462L	50		8.78	0.722			0.326	0.009	0.03 (28%)	2	65	11	72
469*	10	466L	80		2.44	0.189			6.281	0.925	0.20 (89%)	17	76	57	80
481	142	2015	28		33.65	1.364			0.601	0.310	0.03 (21%)	4	76	85	52
482	944	4030S	37		115.17	3.802			4.891	0.230	0.14 (89%)	12	76	57	80
483	132	2015	26		31.02	0.927			0.552	0.039	0.04 (31%)	3	76	85	52
484	735	4154	27		89.67	1.237			1.845	1.348	0.13 (80%)	12	81	73	10
488*	40	482L	37		4.88	0.180			3.944	1.004	0.12 (89%)	11	81	15	68
612	726	1395	77		88.57	3.860			0.060	0.008	0.00 (34%)	14	81	15	68
613	175	2015	37		41.13	2.268			0.013	0.003	0.00 (25%)	14	81	15	68
614	512	2759	28		124.93	3.204			0.054	0.000	0.00 (61%)	0	83	13	42
651	207	2015	55		103.50	1.943			1.357	0.131	0.07 (56%)	6	83	47	8
652	647	2682	33		78.93	2.747			3.234	2.512	0.11 (89%)	10	83	13	42
653	197	2015	53		46.69	2.899			1.072	0.050	0.03 (74%)	3	83	69	8
654	336	2666	17		40.99	0.335									
761	806	3519	82		143.47	7.206									
762	574	1395	66		70.03	2.912									
763	549	3255	60		128.47	8.333									
764	415	2046	32		50.63	1.857									
811	577	2387	87		134.44	6.553									
812	1608	3875S	68		390.74	12.726									
813	504	2170	83		252.00	4.948									
814	567	3875	23		138.35	4.658									
818*	36	812L	68		8.75	0.722									
819*	14	812L	68		3.40	0.137									
831	11	1240	3		5.50	0.054									
832	440	1550	51		220.00	1.488									
833	451	1395	93		105.08	8.373									
834	168	1550	36		82.32	3.180									

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	76	151.50	3.019	2.413	0.606	0.07 (88%)	7	83	47	68
837	268	1395	31	62.44	1.883	0.288	0.034	0.03 (39%)	3	83	13	66
838	347	2790	41	170.03	6.483	2.160	0.072	0.07 (77%)	6	83	69	8
852	1421	3472S	65	554.19	14.363	1.756	0.292	0.10 (26%)	11	85	75	44
854	549	4340	19	133.41	3.844	0.498	0.012	0.03 (18%)	3	85	75	44
858*	36	852L	65	14.04	1.148	0.083	0.007	0.01 (51%)	11	85	75	44
859*	14	852L	65	5.46	0.222	0.024	0.003	0.00 (32%)	11	85	75	44
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	7	28
872	1245	3348S	59	303.78	10.098	1.210	0.209	0.07 (20%)	7	87	33	2
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	7	28
874	613	3379	28	149.57	5.250	1.484	0.027	0.11 (63%)	10	87	33	2
878*	36	872L	59	8.78	0.730	0.079	0.006	0.00 (46%)	7	87	33	2
879*	14	872L	59	3.42	0.143	0.018	0.002	0.00 (20%)	7	87	33	2
891	173	1085	62	40.65	3.151	1.880	0.255	0.04 (88%)	4	89	45	66
892	1211	3364S	58	295.48	10.280	1.650	0.187	0.16 (48%)	16	89	71	40
893	106	1085	38	53.00	0.811	0.752	0.059	0.02 (78%)	2	89	45	66
894	704	2945	37	85.89	2.472	0.272	0.053	0.01 (6%)	1	89	71	40
898*	36	892L	58	8.78	0.715	0.054	0.006	0.00 (40%)	16	89	71	40
899*	14	892L	58	3.42	0.139	0.014	0.002	0.00 (43%)	16	89	71	40
912	1328	3255S	79	162.02	7.743	2.395	0.719	0.12 (31%)	19	91	77	36
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	41	62
914	838	3100	42	204.47	5.816	0.631	0.073	0.09 (37%)	10	91	67	36
918*	50	912L	79	6.10	0.353	0.108	0.027	0.00 (32%)	19	91	77	36
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	49	64
932	671	1395	67	328.79	10.580	0.853	0.333	0.08 (44%)	8	93	69	44
933	72	1085	36	16.92	1.078	0.605	0.049	0.02 (88%)	2	93	49	64
934	412	3643	16	50.26	1.650	0.386	0.007	0.03 (23%)	2	93	69	44
951	248	4294	21	176.08	5.355	1.428	0.013	0.03 (48%)	3	95	27	50
952	1063	3472S	51	531.50	2.552	2.425	0.127	0.15 (49%)	14	95	55	22
953	111	1240	41	55.50	0.928	0.859	0.069	0.03 (82%)	2	95	32	50
954	537	4340	20	209.43	5.960	1.294	0.012	0.07 (49%)	6	95	55	22
958	50	952L	51	25.00	0.120	0.114	0.006	0.01 (49%)	14	95	55	22

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
aaaa	31	978	7212.18	226.262	75.668	13.848	4.39	289.06	31.88
			78.25	5.400	0.612	0.101	0.09	23.20	14.49 BUSES
			7133.92	220.862	75.055	13.747	4.30	265.86	32.30 OTHER

CPU TIME USED SO FAR IS 17.51 SECS

APPENDIX XII

TRANSYT Output for the AM Peak with Two Bus Links
and a Bus Delay Weighting of 10

CBD WEST NETWORK - 108-121 STREET AM PEAK

CBD WEST NETWORK - 108-121 STREET AM PEAK														TRANSYT/7	
CARD NO.	CARD TYPE	CYCLE TIME	STEPS PER CYC.	STOP PENALTY	PERIOD LENGTH	LAG START	LAG END	WEIGHT+ EQUISAT	J.T./S	MARKERS		STEPS OR SECS	SCALE FLOWS	NO.OF COPIES	
1	1	86	43	20	60	2	3	1	1	0	0	0	0	0	

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE	LIST OF NODES TO BE OPTIMISED													
2	2	95	85	81	87	89	91	46	48	83	93	61	76	65	0

HILLCLIMB STEP-SIZE LIST

CARD NO.	CARD TYPE	HILLCLIMB STEP-SIZE LIST
3	4	7 17 -1 7 17 1 -1 0 0 0 0 0 0

REDUCTION OF STOP PENALTY FOR SHORT DELAYS

CARD NO.	CARD TYPE	UPPER LIMIT	REDUCTION OF STOP PENALTY FOR SHORT DELAYS	% STOP PENALTY FOR DELAYS (IN STEPS)	OF
1		2	3	4	9
2		83	96	99	10
3					11
4	5	4			12
5					13
6					14
7					15
8					16
9					17
10					18
11					19
12					20
13					21
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82					90
83					91
84					92
85					93
86					94
87					95
88					96
89					97
90					98
91					99
92					100

LINKS HAVING SHARED STOPLINES

CARD NO.	CARD TYPE	FIRST SET	SECOND SET	THIRD SET
5	7	482	488	
6	7	892	898	
7	7	852	858	

NODE CARDS:

[illegible]

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST			LINK CARDS:			FIXED DATA			LINK LENGTH	STOP PENALTY	SAT FLOW	DELAY WT. X100	DISPSN X100						
				START		LAG	GREEN		LAG	STAGE	END	LAG						STAGE	END				
				STAGE	LAG		STAGE	LAG												STAGE	LAG	STAGE	LAG
21	31	951	95	2	5	0	1	0	0	0	0	0	710	1	4294	0	0						
22	31	952	95	1	5	0	2	0	0	0	0	0	500	1	3472	500	0						
23	31	953	95	2	10	0	1	0	0	0	0	0	500	1	1240	0	0						
24	31	954	95	1	5	0	2	0	0	0	0	0	390	1	4340	0	0						
25	31	958	0	0	0	0	0	0	0	0	0	0	500	1	0	1000	0						
26	31	852	85	1	5	0	2	0	0	0	0	0	390	10	3472	500	0						
27	31	854	85	1	5	0	2	0	0	0	0	0	243	1	4340	0	0						
28	31	858	0	0	0	0	0	0	0	0	0	0	390	10	0	1000	0						

[illegible]

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	ENTRY A LINK NO.	ENTRY A FLOW	ENTRY A TRAVEL TIME	ENTRY B LINK NO.	ENTRY B FLOW	ENTRY B TRAVEL TIME	ENTRY C LINK NO.	ENTRY C FLOW	ENTRY C TRAVEL TIME	ENTRY D LINK NO.	ENTRY D FLOW	ENTRY D TRAVEL TIME
88	32	951	248	0	0	0	0	838	248	45	0	0	0	0	0	0
89	32	952	1063	0	0	0	0	0	0	0	0	0	0	0	0	0
90	32	953	111	0	0	0	0	0	0	0	0	0	0	0	0	0
91	32	954	537	0	0	0	0	854	537	45	0	0	0	0	0	0
92	32	958	50	0	0	0	0	0	0	0	0	0	0	0	0	0
93	32	852	1421	0	953	111	45	952	1060	45	951	18	45	0	0	0
94	32	854	549	0	811	98	40	814	493	40	813	51	40	0	0	0
95	32	858	36	0	0	0	0	958	36	2644	0	0	0	0	0	0
96	32	859	14	0	0	0	0	958	14	2800	0	0	0	0	0	0
97	32	811	577	0	836	449	40	0	0	0	838	99	40	0	0	0
98	32	812	1608	0	0	0	0	852	1419	35	0	0	0	0	0	0
99	32	813	504	0	0	0	0	0	0	0	0	0	0	0	0	0
100	32	814	567	0	871	28	40	874	574	40	873	10	40	0	0	0
101	32	818	36	0	0	0	0	858	36	2422	0	0	0	0	0	0
102	32	819	14	0	0	0	0	859	14	2800	0	0	0	0	0	0
103	32	871	95	0	0	0	35	0	0	0	0	0	0	0	0	0
104	32	872	1245	0	813	85	35	812	1233	35	811	27	35	0	0	0
105	32	873	46	0	0	0	0	0	0	0	0	0	0	0	0	0
106	32	874	613	0	891	32	40	894	606	40	893	15	40	0	0	0
107	32	878	36	0	0	0	0	818	36	2623	0	0	0	0	0	0
108	32	879	14	0	0	0	0	819	14	2800	0	0	0	0	0	0
109	32	891	173	0	0	0	0	931	80	40	934	73	40	0	0	0
110	32	892	1211	0	873	24	35	872	1221	35	871	33	35	0	0	0
111	32	893	106	0	0	0	0	0	0	0	0	0	0	0	0	0
112	32	894	704	0	0	0	0	914	662	40	913	13	40	0	0	0
113	32	898	36	0	0	0	0	878	36	2422	0	0	0	0	0	0
114	32	899	14	0	0	0	0	879	14	2800	0	0	0	0	0	0
115	32	912	1328	0	893	68	35	892	1164	35	891	51	35	0	0	0
116	32	913	115	0	0	0	0	0	0	0	0	0	0	0	0	0
117	32	914	838	0	461	71	40	464	619	40	467	131	40	0	0	0
118	32	918	50	0	0	0	0	898	36	2800	0	0	0	899	14	2800
119	32	461	447	0	0	0	0	761	368	40	764	65	40	0	0	0
120	32	462	925	0	913	59	35	912	960	35	0	0	0	0	0	0
121	32	463	439	0	0	0	0	0	0	0	0	0	0	0	0	0
122	32	464	757	0	481	40	40	484	663	40	483	40	40	0	0	0
123	32	465	224	0	0	0	0	761	224	40	0	0	0	0	0	0
124	32	466	249	0	0	0	0	912	249	35	0	0	0	0	0	0
125	32	467	131	0	0	0	0	0	0	0	0	0	0	0	0	0
126	32	468	36	0	0	0	0	918	36	2622	0	0	0	0	0	0
127	32	469	10	0	0	0	0	918	10	2800	0	0	0	0	0	0
128	32	481	142	0	652	14	40	651	127	40	654	24	40	0	0	0
129	32	482	944	0	0	0	0	462	772	35	465	89	35	0	0	0
130	32	483	132	0	0	0	0	0	0	0	0	0	0	0	0	0
131	32	484	735	0	0	0	0	0	0	0	0	0	0	0	0	0
132	32	488	40	0	0	0	0	468	36	2800	0	0	0	0	0	0
133	32	831	11	0	0	0	0	0	0	0	0	0	0	0	0	0
134	32	832	440	0	0	0	0	0	0	0	0	0	0	0	0	0
135	32	833	451	0	0	0	0	813	137	40	812	237	40	0	0	0
136	32	834	168	0	931	18	40	934	116	40	933	12	40	0	0	0
137	32	836	303	0	0	0	0	0	0	0	0	0	0	0	0	0
138	32	837	268	0	814	12	40	813	231	40	812	100	40	0	0	0
139	32	838	347	0	931	18	40	934	219	40	0	0	0	0	0	0
140	32	931	122	0	0	0	0	0	0	0	0	0	0	0	0	0
141	32	932	671	0	833	443	35	832	429	35	0	0	0	0	0	0
142	32	933	72	0	894	34	40	893	23	40	892	38	40	0	0	0
143	32	934	412	0	0	0	0	614	500	40	613	32	40	0	0	0

145	32	613	175	0	914	69	40	913	318	32	331	10	35	0
146	32	614	512	100	761	60	40	764	302	40	912	101	40	0
147	32	761	806	0	0	0	0	0	0	0	763	15	40	0
148	32	762	574	0	613	37	35	612	582	35	0	0	0	0
149	32	763	549	0	464	81	40	463	439	40	0	153	40	0
150	32	764	415	0	651	58	40	654	284	40	462	52	40	0
151	32	651	207	0	0	0	0	0	0	0	653	0	0	0
152	32	652	647	0	763	36	35	762	528	35	761	83	35	0
153	32	653	197	0	484	35	40	483	77	40	482	76	40	0
154	32	654	336	0	0	0	0	0	0	0	0	0	0	0

INITIAL SETTINGS

LINK NUMBER	NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
461	46	4	0	16	30	33				4.711	0.958	0.12 (99%)	11	46	37	66
462	48	2	0	30						5.284	0.124	0.21 (83%)	19	46	71	32
463	61	2	0	31						3.073	0.130	0.10 (80%)	9	46	37	60
464	65	2	0	29						3.695	0.125	0.11 (52%)	9	46	3	32
465	76	2	0	27						2.056	0.017	0.06 (99%)	5	46	37	66
466	81	2	0	27						1.890	0.734	0.07 (98%)	6	46	71	2
467	83	3	0	13	32					0.290	0.010	0.02 (43%)	1	46	37	0
468*	85	2	0	30						0.125	0.005	0.01 (72%)	19	46	71	32
469*	87	2	0	30						0.069	0.029	0.00 (99%)	6	46	71	2
481	89	2	0	29						1.344	0.026	0.03 (73%)	2	48	65	0
482	91	3	0	24	37					0.839	0.054	0.14 (54%)	15	48	5	60
483	93	2	0	33						0.905	0.022	0.03 (75%)	2	48	65	0
484	95	2	0	30						1.211	0.025	0.08 (38%)	7	48	5	60
488*										0.019	0.002	0.00 (40%)	15	48	5	60
612										0.866	0.646	0.05 (23%)	4	61	5	62
613										1.109	0.056	0.04 (81%)	3	61	67	0
614										0.508	0.026	0.04 (25%)	3	61	5	62
651										1.383	0.054	0.04 (75%)	4	65	63	0
652										1.123	0.060	0.06 (31%)	5	65	5	58
653										1.587	0.047	0.04 (80%)	4	65	63	0
654										0.595	0.012	0.04 (38%)	3	65	5	58
761										5.480	0.415	0.18 (82%)	16	76	59	0
762										1.555	0.426	0.06 (37%)	6	76	5	54
763										2.365	0.139	0.11 (74%)	11	76	59	0
764										0.899	0.047	0.05 (39%)	4	76	5	54
811										7.644	0.530	0.15 (96%)	13	81	59	0
812										6.637	0.496	0.25 (56%)	22	81	5	54
813										3.442	0.440	0.12 (83%)	10	81	59	0
814										1.259	0.021	0.06 (38%)	5	81	5	54
818*										0.186	0.011	0.01 (80%)	22	81	5	54
819*										0.034	0.004	0.00 (38%)	22	81	5	54
831										0.046	0.000	0.00 (57%)	0	83	31	64
832										1.667	0.172	0.08 (63%)	7	83	69	26
833										2.680	0.894	0.11 (85%)	9	83	31	64
834										1.106	0.062	0.04 (76%)	3	83	3	26

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	84	151.50	3.623	2.569	1.054	0.08 (91%)	7	83	69	2
837	268	1395	30	62.44	2.368	0.777	0.031	0.04 (52%)	3	83	31	0
838	347	2790	45	170.03	6.447	2.107	0.089	0.07 (77%)	6	83	3	26
852	1421	3472S	65	554.19	15.551	2.944	0.292	0.17 (42%)	15	85	5	60
854	549	4340	19	133.41	4.140	0.793	0.012	0.05 (33%)	4	85	5	60
858*	36	852L	65	14.04	1.140	0.076	0.007	0.01 (51%)	15	85	5	60
859*	14	852L	65	5.46	0.240	0.042	0.003	0.00 (60%)	15	85	5	60
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	65	0
872	1245	3348S	59	303.78	11.685	2.797	0.209	0.13 (39%)	13	87	5	60
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	65	0
874	613	3379	28	149.57	5.159	1.392	0.027	0.07 (44%)	7	87	5	60
878*	36	872L	59	8.78	0.784	0.133	0.006	0.01 (69%)	13	87	5	60
879*	14	872L	59	3.42	0.177	0.053	0.002	0.00 (60%)	13	87	5	60
891	173	1085	57	40.65	2.990	1.785	0.189	0.04 (89%)	4	89	63	0
892	1211	3364S	60	295.48	12.529	3.875	0.212	0.18 (53%)	16	89	5	58
893	106	1085	35	53.00	0.752	0.705	0.047	0.02 (75%)	2	89	63	0
894	704	2945	38	85.89	2.667	0.461	0.058	0.04 (22%)	5	89	5	58
898*	36	892L	60	8.78	0.800	0.138	0.006	0.01 (66%)	16	89	5	58
899*	14	892L	60	3.42	0.157	0.032	0.002	0.00 (40%)	16	89	5	58
912	1328	3255S	79	162.02	9.565	4.217	0.719	0.15 (40%)	15	91	3	48
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	53	74
914	838	3100	42	204.47	6.613	1.428	0.073	0.08 (33%)	7	91	79	48
918*	50	912L	79	6.10	0.382	0.137	0.027	0.00 (31%)	15	91	3	48
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	71	0
932	671	1395	67	328.79	10.729	1.002	0.333	0.09 (47%)	8	93	5	66
933	72	1085	36	16.92	1.011	0.539	0.049	0.02 (79%)	1	93	71	0
934	412	3643	16	50.26	1.487	0.224	0.007	0.01 (13%)	1	93	5	66
951	248	4294	23	176.08	4.899	0.969	0.016	0.04 (62%)	4	95	65	0
952	1063	3472S	49	531.50	2.237	2.123	0.114	0.14 (46%)	13	95	5	60
953	111	1240	45	55.50	1.005	0.912	0.093	0.03 (85%)	2	95	70	0
954	537	4340	19	209.43	5.604	0.939	0.011	0.06 (38%)	5	95	5	60
958	50	952L	49	25.00	0.105	0.100	0.005	0.01 (46%)	13	95	5	60

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
aaaa	1	83	7212.18	251.315	103.758	10.811	5.67	425.26	28.70
			78.25	5.837	1.044	0.106	0.12	13.89	13.41 BUSES
			7133.92	245.478	102.714	10.704	5.55	411.37	29.06 OTHER

CPU TIME USED SO FAR IS 0.80 SECS

CPU TIME USED SO FAR IS 5.38 SECS

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17 -1

46	4	21	37	8	11
48	2	14	1		
61	2	36	24		
65	2	3	36		
76	2	41	27		
81	2	5	34		
83	3	36	7	24	
85	2	36	23		
87	2	21	8		
89	2	35	22		
91	3	36	17	30	
93	2	36	26		
95	2	36	23		

	35	973	7212.18	230.005	79.398	13.860	5.12	301.30	31.36
aaaa									
			78.25	5.429	0.641	0.101	0.10	9.43	14.41 BUSES
			7133.92	224.576	78.757	13.759	5.02	291.87	31.77 OTHER

CPU TIME USED SO FAR IS 7.18 SECS

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17 -1 7

46	4	21	37	8	11
48	2	14	1		
61	2	36	24		
65	2	3	36		
76	2	41	27		
81	2	5	34		
83	3	36	7	24	
85	2	36	23		
87	2	14	1		
89	2	28	15		
91	3	36	17	30	
93	2	36	26		
95	2	29	16		
aaaa		30	1097		7212.18

78.25	5.406	0.619	0.101	0.10	9.14	14.47	BUSES
7133.92	222.013	76.193	13.759	4.50	274.01	32.13	OTHER

CPU TIME USED SO FAR IS 9.23 SECS

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17 -1 7 17

46
48
61
65
76
81
83
85
87
89
91
93
95

4 21 37 8 11
2 14 1
2 36 24
2 3 36
2 41 27
2 5 34
3 36 7 24
2 36 23
2 14 1
2 28 15
3 36 17 30
2 36 26
2 29 16

aaaa

27 1019 7212.18 227.419 76.812 13.860 4.60 283.15 31.71

0.10 9.14 14.47 BUSES
4.50 274.01 32.13 OTHER

CPU TIME USED SO FAR IS 11.11 SECS

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :-

46	4	20	36	7	10
48	2	16	3		
61	2	36	24		
65	2	3	36		
76	2	40	26		
81	2	5	34		
83	3	35	6	23	
85	2	35	22		
87	2	14	1		
89	2	33	20		
91	3	37	18	31	
93	2	33	23		
95	2	26	13		

aaaa	42	1314	7212.18	226.504	75.897	13.860	4.47	274.08	31.84
			78.25	5.404	0.617	0.101	0.09	9.02	14.48 BUSES
			7133.92	221.100	75.281	13.759	4.37	265.06	32.27 OTHER

CPU TIME USED SO FAR IS 13.54 SECS

1-1

[illegible]

Daadaa

Daaa	32	964	7212.18	226.498	75.904	13.848	4.38	273.36	31.84
			78.25	5.405	0.617	0.101	0.09	9.00	14.48 BUSES
			7133.92	221.093	75.287	13.747	4.29	264.35	32.27 OTHER

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CPU TIME USED SO FAR IS 15.30 SECS
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FINAL SETTINGS OBTAINED WITH STEP SIZES :- 7 17 -1 7 17 1 -1 1

LINK NUMBER	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
461	4	20	36	7	10				1.163	0.958	0.08 (65%)	9	46	77	20
462	2	16	3						0.987	0.124	0.10 (38%)	11	46	25	72
463	2	35	23						3.073	0.130	0.10 (80%)	9	46	77	14
464	2	3	36						3.455	0.125	0.12 (58%)	12	46	43	72
465	2	40	26						0.208	0.017	0.01 (10%)	1	46	77	20
466	2	5	34						1.761	0.734	0.05 (79%)	5	46	25	42
467	3	33	4	21					0.290	0.010	0.02 (43%)	1	46	77	40
468*	2	35	22						0.082	0.005	0.00 (36%)	11	46	25	72
469*	2	14	1						0.072	0.029	0.00 (76%)	5	46	25	42
481	2	33	20						0.496	0.026	0.01 (33%)	1	48	11	32
482	3	37	18	31					0.457	0.054	0.03 (12%)	4	48	37	6
483	2	32	22						0.905	0.022	0.03 (75%)	2	48	11	32
484	2	25	11						1.211	0.025	0.08 (38%)	7	48	37	6
488*	2	40							0.004	0.002	0.00 (8%)	4	48	37	6
612	2	726	1395						0.683	0.646	0.04 (20%)	4	61	75	46
613	2	175	2015						1.185	0.056	0.04 (80%)	3	61	51	70
614	2	512	2759						0.665	0.026	0.04 (29%)	4	61	75	46
651	2	207	2015						1.773	0.169	0.05 (87%)	4	65	77	6
652	2	647	2682						0.450	0.042	0.03 (19%)	3	65	11	72
653	2	197	2015						1.587	0.145	0.05 (89%)	4	65	77	6
654	2	336	2666						0.326	0.009	0.03 (28%)	2	65	11	72
761	2	806	3519						6.281	0.925	0.20 (89%)	17	76	57	80
762	2	574	1395						0.601	0.310	0.03 (21%)	4	76	85	52
763	2	549	3255						4.891	0.230	0.14 (89%)	12	76	57	80
764	2	415	2046						0.552	0.039	0.04 (31%)	3	76	85	52
811	2	577	2387						1.845	1.348	0.13 (80%)	12	81	73	10
812	2	1608	3875S						1.209	0.353	0.11 (25%)	14	81	15	68
813	2	504	2170						3.944	1.004	0.12 (89%)	11	81	73	10
814	2	567	3875						1.181	0.018	0.06 (36%)	5	81	15	68
818*	2	36	812L						0.060	0.008	0.00 (34%)	14	81	15	68
819*	2	14	812L						0.013	0.003	0.00 (25%)	14	81	15	68
831	2	11	1240						0.054	0.000	0.00 (61%)	0	83	13	42
832	2	440	1550						1.357	0.131	0.07 (56%)	6	83	47	8
833	2	451	1395						3.234	2.512	0.11 (89%)	10	83	13	42
834	2	168	1550						1.072	0.050	0.03 (74%)	3	83	69	8

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	76	151.50	3.019	2.413	0.606	0.07 (88%)	7	83	47	68
837	268	1395	31	62.44	1.883	0.288	0.034	0.03 (39%)	3	83	13	66
838	347	2790	41	170.03	6.483	2.160	0.072	0.07 (77%)	6	83	69	8
852	1421	3472S	65	554.19	14.363	1.756	0.292	0.10 (26%)	11	85	75	44
854	549	4340	19	133.41	3.844	0.498	0.012	0.03 (18%)	3	85	75	44
858*	36	852L	65	14.04	1.148	0.083	0.007	0.01 (51%)	11	85	75	44
859*	14	852L	65	5.46	0.222	0.024	0.003	0.00 (32%)	11	85	75	44
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	7	28
872	1245	3348S	59	303.78	10.098	1.210	0.209	0.07 (20%)	7	87	33	2
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	7	28
874	613	3379	28	149.57	5.250	1.484	0.027	0.11 (63%)	10	87	33	2
878*	36	872L	59	8.78	0.730	0.079	0.006	0.00 (46%)	7	87	33	2
879*	14	872L	59	3.42	0.143	0.018	0.002	0.00 (20%)	7	87	33	2
891	173	1085	62	40.65	3.151	1.880	0.255	0.04 (88%)	4	89	45	66
892	1211	3364S	58	295.48	10.280	1.650	0.187	0.16 (48%)	16	89	71	40
893	106	1085	38	53.00	0.811	0.752	0.059	0.02 (78%)	2	89	45	66
894	704	2945	37	85.89	2.472	0.272	0.053	0.01 (6%)	1	89	71	40
898*	36	892L	58	8.78	0.715	0.054	0.006	0.00 (40%)	16	89	71	40
899*	14	892L	58	3.42	0.139	0.014	0.002	0.00 (43%)	16	89	71	40
912	1328	3255S	79	162.02	7.743	2.395	0.719	0.12 (31%)	19	91	77	36
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	41	62
914	838	3100	42	204.47	5.816	0.631	0.073	0.09 (37%)	10	91	67	36
918*	50	912L	79	6.10	0.353	0.108	0.027	0.00 (32%)	19	91	77	36
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	49	64
932	671	1395	67	328.79	10.580	0.853	0.333	0.08 (44%)	8	93	69	44
933	72	1085	36	16.92	1.078	0.605	0.049	0.02 (88%)	2	93	49	64
934	412	3643	16	50.26	1.650	0.386	0.007	0.03 (23%)	2	93	69	44
951	248	4294	21	176.08	5.355	1.428	0.013	0.03 (48%)	3	95	27	50
952	1063	3472S	51	531.50	2.552	2.425	0.127	0.15 (49%)	14	95	55	22
953	111	1240	41	55.50	0.928	0.859	0.069	0.03 (82%)	2	95	32	50
954	537	4340	20	209.43	5.960	1.294	0.012	0.07 (49%)	6	95	55	22
958	50	952L	51	25.00	0.120	0.114	0.006	0.01 (49%)	14	95	55	22

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
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7aaaa	31	978	7212.18	226.262	75.668	13.848	4.39	272.39	31.88
			78.25	5.400	0.612	0.101	0.09	8.94	14.49 BUSES
			7133.92	220.862	75.055	13.747	4.30	263.46	32.30 OTHER

CPU TIME USED SO FAR IS 17.25 SECS

APPENDIX XIII

TRANSYT Output for the AM Peak with Two Bus Links
and a Bus Delay Weighting of 5

CBD WEST NETWORK - 108-121 STREET AM PEAK

TRANSYT/7

CARD NO.	CARD TYPE	CYCLE TIME	STEPS PER CYC.	STOP PERIOD	LAG START	LAG END	WEIGHT+ EQUISAT	J.T./S	PRINT	CHECK	OR SECS	MARKERS	SCALE FLOWS	NO. OF COPIES
1	1	86	43	20	60	2	3	1	1	0	0	0	0	0

LIST OF NODES TO BE OPTIMISED

CARD NO.	CARD TYPE	85	81	87	89	91	46	48	83	93	61	76	65	0
2	2	95												0

HILLCLIMB STEP-SIZE LIST

CARD NO.	CARD TYPE	7	17	-1	7	17	1	-1	1	0	0	0	0	0
3	4													0

REDUCTION OF STOP PENALTY FOR SHORT DELAYS (IN STEPS) OF

CARD NO.	CARD TYPE	UPPER LIMIT	1	2	3	4	5	6	7	8	9	10	11	12	13	14
4	5	4	62	83	96	99	0	0	0	0	0	0	0	0	0	0

LINKS HAVING SHARED STOPLINES

CARD NO.	CARD TYPE	FIRST SET	SECOND SET	THIRD SET
5	7	482	488	912
6	7	892	898	812
7	7	852	858	466

LINK CARDS: STAGE 1 STAGE 2 STAGE 3 STAGE 4 STAGE 5 STAGE 6 STAGE 7

CARD NO.	CARD TYPE	NO.	CHANGE	MIN	CHANGE	MIN	CHANGE	MIN	CHANGE	MIN	CHANGE	MIN	CHANGE	MIN	CHANGE	MIN
8	12	95	0	26	0	26	0	26	0	26	0	26	0	26	0	26
9	12	85	0	10	0	26	0	26	0	26	0	26	0	26	0	26
10	12	81	0	22	0	28	0	26	0	26	0	26	0	26	0	26
11	12	87	0	21	0	26	0	26	0	26	0	26	0	26	0	26
12	12	89	0	21	0	26	0	26	0	26	0	26	0	26	0	26
13	13	91	0	23	0	26	0	26	0	26	0	26	0	26	0	26
14	14	46	0	32	0	28	0	30	0	30	0	30	0	30	0	30
15	12	48	0	22	0	26	0	30	0	30	0	30	0	30	0	30
16	13	83	0	25	0	26	0	30	0	30	0	30	0	30	0	30
17	12	93	0	17	0	20	0	30	0	30	0	30	0	30	0	30
18	12	61	0	20	0	24	0	30	0	30	0	30	0	30	0	30
19	12	76	0	28	0	23	0	30	0	30	0	30	0	30	0	30
20	12	65	0	22	0	20	0	30	0	30	0	30	0	30	0	30

LINK CARDS: FIXED DATA

CARD NO.	CARD TYPE	LINK NO.	EXIT NODE	FIRST GREEN	START STAGE	LAG	END STAGE	SECOND GREEN	START STAGE	LAG	END STAGE	LINK LENGTH	STOP PENALTY	SAT FLOW	DELAY WT.X100	DISPSN X100
21	31	951	95	2	5	0	1	0	0	0	0	710	1	4294	0	0
22	31	952	95	1	5	0	2	0	0	0	0	500	1	3472	500	0
23	31	953	95	2	10	0	1	0	0	0	0	500	1	1240	0	0
24	31	954	95	1	5	0	2	0	0	0	0	390	1	4340	0	0
25	31	958	0	0	0	0	0	0	0	0	0	500	1	0	500	0
26	31	852	85	1	5	0	2	0	0	0	0	390	10	3472	500	0
27	31	854	85	1	5	0	2	0	0	0	0	243	1	4340	500	0
28	31	858	0	0	0	0	0	0	0	0	0	390	10	0	500	0
29	31	859	0	0	0	0	0	0	0	0	0	390	10	0	500	0
30	31	811	81	2	5	0	1	0	0	0	0	233	1	2387	0	0
31	31	812	81	1	5	0	2	0	0	0	0	243	1	3875	500	0
32	31	813	81	2	5	0	1	0	0	0	0	500	1	2170	0	0

CARD NO.	CARD TYPE	LINK NO.	TOTAL FLOW	UNIFORM FLOW	LINK CARDS:				FLOW DATA				ENTRY A LINK NO.	ENTRY B LINK NO.	ENTRY C LINK NO.	ENTRY D LINK NO.	TRAVEL TIME	FLOW	TRAVEL TIME
					ENTRY A LINK NO.	ENTRY B LINK NO.	ENTRY C LINK NO.	ENTRY D LINK NO.	ENTRY A LINK NO.	ENTRY B LINK NO.	ENTRY C LINK NO.	ENTRY D LINK NO.							
36	31	871	87	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
37	31	872	87	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
38	31	873	87	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	31	874	87	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
40	31	878	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	31	879	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	31	891	89	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
43	31	892	89	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
44	31	893	89	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
45	31	894	89	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
46	31	898	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	31	899	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	31	912	91	1	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0
49	31	913	91	2	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0
50	31	914	91	3	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
51	31	918	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	31	461	46	2	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0
53	31	462	46	4	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
54	31	463	46	2	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0
55	31	464	46	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
56	31	465	46	2	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0
57	31	466	46	4	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
58	31	467	46	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
59	31	468	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	31	469	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	31	481	48	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
62	31	482	48	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
63	31	483	48	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
64	31	484	48	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
65	31	488	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	31	831	83	2	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0
67	31	832	83	3	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
68	31	833	83	2	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0
69	31	834	83	1	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0
70	31	836	83	3	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
71	31	837	83	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
72	31	838	83	1	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0
73	31	931	93	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
74	31	932	93	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
75	31	933	93	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
76	31	934	93	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
77	31	612	61	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
78	31	613	61	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
79	31	614	61	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
80	31	761	76	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
81	31	762	76	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
82	31	763	76	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
83	31	764	76	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
84	31	651	65	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
85	31	652	65	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0
86	31	653	65	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
87	31	654	65	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0

[illegible]

INITIAL SETTINGS

LINK NUMBER	NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
461	46	4	0	16	30	33				0.12 (99%)	11	46	37	66
462	48	2	0	30						0.21 (83%)	19	46	71	32
463	61	2	0	31						0.10 (80%)	9	46	37	60
464	65	2	0	29						0.11 (52%)	9	46	3	32
465	76	2	0	27						0.06 (99%)	5	46	37	66
466	81	2	0	27						0.07 (98%)	6	46	71	2
467	83	3	0	13	32					0.02 (43%)	1	46	37	0
468*	85	2	0	30						0.01 (72%)	19	46	71	32
469*	87	2	0	30						0.00 (99%)	6	46	71	2
481	89	2	0	29						0.03 (73%)	2	48	65	0
482	91	3	0	24	37					0.14 (54%)	15	48	5	60
483	93	2	0	33						0.03 (75%)	2	48	65	0
484	95	2	0	30						0.08 (38%)	7	48	5	60
488*										0.00 (40%)	15	48	5	60
612										0.05 (23%)	4	61	5	62
613										0.04 (81%)	3	61	67	0
614										0.04 (25%)	3	61	5	62
651										0.04 (75%)	4	65	63	0
652										0.06 (31%)	5	65	5	58
653										0.04 (80%)	4	65	63	0
654										0.04 (38%)	3	65	5	58
761										0.18 (82%)	16	76	59	0
762										0.06 (37%)	6	76	5	54
763										0.11 (74%)	11	76	59	0
764										0.05 (39%)	4	76	5	54
811										0.15 (96%)	13	81	59	0
812										0.25 (56%)	22	81	5	54
813										0.12 (83%)	10	81	59	0
814										0.06 (38%)	5	81	5	54
818*										0.01 (80%)	22	81	5	54
819*										0.00 (38%)	22	81	5	54
831										0.00 (57%)	0	83	31	64
832										0.08 (63%)	7	83	69	26
833										0.11 (85%)	9	83	31	64
834										0.04 (76%)	3	83	3	26

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	84	151.50	3.623	2.569	1.054	0.08 (91%)	7	83	69	2
837	268	1395	30	62.44	2.368	0.777	0.031	0.04 (52%)	3	83	31	0
838	347	2790	45	170.03	6.447	2.107	0.089	0.07 (77%)	6	83	3	26
852	1421	3472S	65	554.19	15.551	2.944	0.292	0.17 (42%)	15	85	5	60
854	549	4340	19	133.41	4.140	0.793	0.012	0.05 (33%)	4	85	5	60
858*	36	852L	65	14.04	1.140	0.076	0.007	0.01 (51%)	15	85	5	60
859*	14	852L	65	5.46	0.240	0.042	0.003	0.00 (60%)	15	85	5	60
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	65	0
872	1245	3348S	59	303.78	11.685	2.797	0.209	0.13 (39%)	13	87	5	60
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	65	0
874	613	3379	28	149.57	5.159	1.392	0.027	0.07 (44%)	7	87	5	60
878*	36	872L	59	8.78	0.784	0.133	0.006	0.01 (69%)	13	87	5	60
879*	14	872L	59	3.42	0.177	0.053	0.002	0.00 (60%)	13	87	5	60
891	173	1085	57	40.65	2.990	1.785	0.189	0.04 (89%)	4	89	63	0
892	1211	3364S	60	295.48	12.529	3.875	0.212	0.18 (53%)	16	89	5	58
893	106	1085	35	53.00	0.752	0.705	0.047	0.02 (75%)	2	89	63	0
894	704	2945	38	85.89	2.667	0.461	0.058	0.04 (22%)	5	89	5	58
898*	36	892L	60	8.78	0.800	0.138	0.006	0.01 (66%)	16	89	5	58
899*	14	892L	60	3.42	0.157	0.032	0.002	0.00 (40%)	16	89	5	58
912	1328	3255S	79	162.02	9.565	4.217	0.719	0.15 (40%)	15	91	3	48
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	53	74
914	838	3100	42	204.47	6.613	1.428	0.073	0.08 (33%)	7	91	79	48
918*	50	912L	79	6.10	0.382	0.137	0.027	0.00 (31%)	15	91	3	48
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	71	0
932	671	1395	67	328.79	10.729	1.002	0.333	0.09 (47%)	8	93	5	66
933	72	1085	36	16.92	1.011	0.539	0.049	0.02 (79%)	1	93	71	0
934	412	3643	16	50.26	1.487	0.224	0.007	0.01 (13%)	1	93	5	66
951	248	4294	23	176.08	4.899	0.969	0.016	0.04 (62%)	4	95	65	0
952	1063	3472S	49	531.50	2.237	2.123	0.114	0.14 (46%)	13	95	5	60
953	111	1240	45	55.50	1.005	0.912	0.093	0.03 (85%)	2	95	70	0
954	537	4340	19	209.43	5.604	0.939	0.011	0.06 (38%)	5	95	5	60
958	50	952L	49	25.00	0.105	0.100	0.005	0.01 (46%)	13	95	5	60

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	SUBPT NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
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aaaa	1	83	7212.18	251.315	103.758	10.811	5.67	418.99	28.70
			78.25	5.837	1.044	0.106	0.12	8.14	13.41 BUSES
			7133.92	245.478	102.714	10.704	5.55	410.84	29.06 OTHER

CPU TIME USED SO FAR IS 0.53 SECS

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7

Line Item	46	4	21	37	8	11	227.500	79.943	10.811	5.17	304.66	31.70	14.30	BUSES
46	21	37	8	11										
48	14	1												
61	36	24												
65	7	36												
76	0	27												
81	7	34												
83	36	6	25											
85	36	23												
87	21	8												
89	36	22												
91	36	17	30											
93	36	26												
95	36	23												
aaaa	39	1419			7212.18	227.500	79.943	10.811	5.17	304.66	31.70	14.30	BUSES	
					78.25	5.474	0.680	0.106	0.10	5.96				
					7133.92	222.027	79.263	10.704	5.07	298.70	32.13	OTHER		

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17

	46	48	61	65	76	81	83	85	87	89	91	93	95
	4	2	2	2	2	2	3	2	2	2	3	2	2
	21	14	36	7	0	7	36	36	21	36	36	36	36
	37	1	24	36	27	34	6	23	8	22	17	26	23
	8	11					25			30			
yaaaa	27												
	1077												
	7212.18	227.500	79.943	10.811	5.17	304.66	31.70						
	78.25	5.474	0.680	0.106	0.10	5.96	14.30	BUSES					
	7133.92	222.027	79.263	10.704	5.07	298.70	32.13	OTHER					

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CPU TIME USED SO FAR IS      5.03 SECS

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INTERMEDIATE SETTINGS - STEP SIZES. SO FAR :- 7 17 -1

[illegible]

CPU TIME USED SO FAR IS 6.80 SECS

INTERMEDIATE SETTINGS - STEP SIZES SO FAR :- 7 17 -1 7

[illegible]

CPU TIME USED SO FAR IS 8.87 SECS

	7	17	-1	7	17
INTERMEDIATE SFTTINGS - STEP SIZES SO FAR :-	7	17	-1	7	17

46
48
51
55
76
81
83
85
87
89
91
93
95

Aaaaa

31.69

278.24

4.55

13 860

76 960

27 567

7212 18

CC-0

75

:

14.36 BUSES

5.71

0.10

0.101

0551

5 449

78 25

32.12 OTHER

272.53

4 45

13 759

76 299

22 110

7422 02

CPU TIME USED SO FAR IS 10.69 SECS

LINK NUMBER	NODE NO	NUMBER OF STAGES	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
46	461	4	20	36	7	10				1.163	0.958	0.08 (65%)	9	46	77	20
48	462	2	16	3						0.987	0.124	0.10 (38%)	11	46	25	72
61	463	2	35	23						3.073	0.130	0.10 (80%)	9	46	77	14
65	464	2	3	36						3.455	0.125	0.12 (58%)	12	46	43	72
76	465	2	40	26						0.208	0.017	0.01 (10%)	1	46	77	20
81	466	2	5	34						1.761	0.734	0.05 (79%)	5	46	25	42
83	467	3	33	3	21					0.290	0.010	0.02 (43%)	1	46	77	40
85	468*	2	35	22						0.082	0.005	0.00 (36%)	11	46	25	72
87	469*	2	14	1						0.072	0.029	0.00 (76%)	5	46	25	42
89	481	2	33	20						0.496	0.026	0.01 (33%)	1	48	11	32
91	482	3	37	18	31					0.457	0.054	0.03 (12%)	4	48	37	6
93	483	2	32	22						0.905	0.022	0.03 (75%)	2	48	11	32
95	484	2	25	11						1.211	0.025	0.08 (38%)	7	48	37	6
	488*									0.004	0.002	0.00 (8%)	4	48	37	6
	612	726	1395	2015	2682	482L	4.736	7.559	3.863	0.686	0.646	0.04 (20%)	4	61	75	46
613	175	512	2015	2759	2015	41.13	2.268	3.204	2.268	1.185	0.056	0.04 (80%)	3	61	51	70
614	207	647	2015	2682	2015	124.93	3.204	1.943	3.204	0.665	0.026	0.04 (29%)	4	61	75	46
651	207	647	2015	2682	2015	103.50	1.943	2.747	1.943	1.773	0.169	0.05 (87%)	4	65	77	6
652	197	336	2015	2682	2015	78.93	2.747	2.899	2.747	0.450	0.042	0.03 (19%)	3	65	11	72
653	336	806	2666	3519	2015	46.69	2.899	0.335	2.899	1.587	0.145	0.05 (89%)	4	65	77	6
654	806	574	1395	3255	2015	40.99	0.335	7.206	0.335	0.326	0.009	0.03 (28%)	2	65	11	72
761	574	549	415	2046	2387	143.47	7.206	2.913	7.206	6.281	0.925	0.20 (89%)	17	76	57	80
762	549	415	577	1608	3875S	70.03	2.913	8.333	2.913	0.602	0.310	0.03 (21%)	4	76	85	52
763	577	1608	3875S	2170	3875	128.47	8.333	1.857	8.333	4.891	0.230	0.14 (89%)	12	76	57	80
764	1608	504	567	36	812L	50.63	1.857	6.542	1.857	0.552	0.039	0.04 (31%)	3	76	85	52
811	504	567	36	812L	812L	134.44	6.542	12.726	6.542	1.833	1.348	0.13 (80%)	12	81	73	10
812	567	36	812L	812L	812L	390.74	12.726	4.948	12.726	1.209	0.353	0.11 (25%)	14	81	15	68
813	36	812L	812L	812L	812L	252.00	4.948	4.658	4.948	3.944	1.004	0.12 (89%)	11	81	73	10
814	14	1240	1550	1395	1550	138.35	4.658	0.722	4.658	1.181	0.018	0.06 (36%)	5	81	15	68
818*	36	812L	812L	812L	812L	8.75	0.722	0.137	0.722	0.060	0.008	0.00 (34%)	14	81	15	68
819*	14	1240	1550	1395	1550	3.40	0.137	0.050	0.137	0.013	0.003	0.00 (25%)	14	81	15	68
831	11	440	451	168	168	5.50	0.050	1.658	0.050	0.050	0.000	0.00 (59%)	0	83	11	42
832	440	451	168	168	168	220.00	1.658	7.000	1.658	1.508	0.150	0.07 (60%)	7	83	47	6
833	451	168	168	168	168	105.08	7.000	3.007	7.000	3.007	1.366	0.11 (85%)	9	83	11	42
834	168	168	168	168	168	82.32	3.271	1.152	3.271	1.152	0.062	0.04 (77%)	3	83	69	6

LINK NUMBER	FLOW (VEH/H)	SAT FLOW (VEH/H)	DEGREE OF SAT (%)	DISTANCE TRAVELLED (VEH KM/H)	TIME SPENT (VEH H/H)	UNIFORM DELAY (VEH H/H)	RANDOM DELAY (VEH H/H)	UNIFORM STOPS (VEH/SEC)	MAX BACK OF QUEUE (VEH)	EXIT SIGNAL	GREEN START (SEC)	PERIOD END (SEC)
836	303	1550	76	151.50	3.019	2.413	0.606	0.07 (88%)	7	83	47	68
837	268	1395	30	62.44	1.814	0.222	0.031	0.02 (29%)	2	83	11	66
838	347	2790	45	170.03	6.616	2.275	0.089	0.08 (78%)	7	83	69	6
852	1421	3472S	65	554.19	14.363	1.755	0.292	0.10 (26%)	11	85	75	44
854	549	4340	19	133.41	3.845	0.498	0.012	0.03 (18%)	3	85	75	44
858*	36	852L	65	14.04	1.148	0.083	0.007	0.01 (51%)	11	85	75	44
859*	14	852L	65	5.46	0.222	0.024	0.003	0.00 (32%)	11	85	75	44
871	95	1085	34	47.50	0.712	0.667	0.044	0.02 (78%)	2	87	7	28
872	1245	3348S	59	303.78	10.098	1.210	0.209	0.07 (20%)	7	87	33	2
873	46	1085	17	23.00	0.315	0.307	0.008	0.01 (73%)	1	87	7	28
874	613	3379	28	149.57	5.250	1.484	0.027	0.11 (63%)	10	87	33	2
878*	36	872L	59	8.78	0.730	0.079	0.006	0.00 (46%)	7	87	33	2
879*	14	872L	59	3.42	0.143	0.018	0.002	0.00 (20%)	7	87	33	2
891	173	1085	62	40.65	3.151	1.880	0.255	0.04 (88%)	4	89	45	66
892	1211	3364S	58	295.48	10.280	1.650	0.187	0.16 (48%)	16	89	71	40
893	106	1085	38	53.00	0.811	0.752	0.059	0.02 (78%)	2	89	45	66
894	704	2945	37	85.89	2.472	0.272	0.053	0.01 (6%)	1	89	71	40
898*	36	892L	58	8.78	0.715	0.054	0.006	0.00 (40%)	16	89	71	40
899*	14	892L	58	3.42	0.139	0.014	0.002	0.00 (43%)	16	89	71	40
912	1328	3255S	79	162.02	7.743	2.395	0.719	0.12 (31%)	19	91	77	36
913	115	2115	21	57.50	0.793	0.779	0.014	0.02 (75%)	2	91	41	62
914	838	3100	42	204.47	5.816	0.631	0.073	0.09 (37%)	10	91	67	36
918*	50	912L	79	6.10	0.353	0.108	0.027	0.00 (32%)	19	91	77	36
931	122	1085	60	61.00	1.284	1.056	0.228	0.03 (87%)	3	93	49	64
932	671	1395	67	328.79	10.651	0.924	0.333	0.08 (46%)	8	93	69	44
933	72	1085	36	16.92	1.078	0.605	0.049	0.02 (88%)	2	93	49	64
934	412	3643	16	50.26	1.650	0.386	0.007	0.03 (23%)	2	93	69	44
951	248	4294	21	176.08	5.332	1.406	0.013	0.03 (47%)	3	95	27	50
952	1063	3472S	51	531.50	2.552	2.425	0.127	0.15 (49%)	14	95	55	22
953	111	1240	41	55.50	0.928	0.859	0.069	0.03 (82%)	2	95	32	50
954	537	4340	20	209.43	5.960	1.294	0.012	0.07 (49%)	6	95	55	22
958	50	952L	51	25.00	0.120	0.114	0.006	0.01 (49%)	14	95	55	22

TIME SINCE START OF RUN	USE OF SUBROUTINE NO. OF ENTRIES	NO. OF LINKS	TOTAL DISTANCE TRAVELLED (VEH KM/H)	TOTAL TIME SPENT (VEH H/H)	TOTAL UNIFORM DELAY (VEH H/H)	TOTAL RANDOM DELAY (VEH H/H)	TOTAL UNIFORM STOPS (VEH/SEC)	PERFORMANCE INDEX	SPEED (KM/H)
aaaa	29	941	7212.18	225.251	75.757	12.747	4.39	268.16	32.02
			78.25	5.400	0.612	0.101	0.09	5.37	14.49 BUSES
			7133.92	219.850	75.145	12.646	4.30	262.79	32.45 OTHER

CPU TIME USED SO FAR IS 16.52 SECS



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